UNIVERSITEIT GENT

FACULTEIT PSYCHOLOGIE EN PEDAGOGISCHE WETENSCHAPPEN

The challenge of assessing and promoting late primary school children's self-regulated learning. Exploring the impact of student tutoring.

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Proefschrift ingediend tot het behalen van de academische graad van Doctor in de Pedagogische Wetenschappen

2015

VOORWOORD

Met het schrijven van dit voorwoord kondigt zich het einde van mijn doctoraatstraject aan. Een traject dat zeven jaar geleden startte en groeide vanuit mijn medewerking als projectcoördinator van TutorBabbel. Tijdens deze uitdagende onderneming kon ik rekenen op de hulp van velen.

Als eerste wil ik **mijn promotor, prof. dr. Hilde Van Keer,** bedanken. Bedankt, Hilde, om van bij de start in me te geloven en me dat extra duwtje in de rug te geven om een doctoraat te starten. Ik bewonder jouw grenzeloos enthousiasme en doorzettingsvermogen, jouw deskundigheid en nauwgezetheid. Tijdens onze talloze overlegmomenten had je steeds maar een half woord nodig om te weten wat ik bedoelde en kon je als de beste mijn hersenkronkels volgen. Ik prijs mezelf ongelofelijk gelukkig dat ik mijn doctoraat onder jouw promotorschap mocht volbrengen.

Ook de **leden van mijn begeleidingscommissie**, prof. dr. Koen Lombaerts, prof. dr. Yves Rosseel, prof. dr. Bernadette van Hout-Wolters en prof. dr. Keith Topping, wil ik bedanken voor hun kritische blik, nauwe betrokkenheid en constructieve feedback. Koen, bedankt voor jouw input tijdens de ontwikkeling van de vragenlijst. Yves, bedankt dat ik bij jou mocht aankloppen met mijn statistische vraagstukken. Bernadette, ik ben blij dat ik jou via deze weg heb leren kennen. Ik heb onze gesprekken en samenwerking in de voorbije jaren enorm geapprecieerd. Keith, I was honoured when you agreed to be a member of my guidance committee. Thank you for attending the multiple meetings in Ghent, your commitment and detailed feedback.

Ook mede dankzij mijn **collega's van de Vakgroep Onderwijskunde en (nieuwe) bureaugenootjes**, kijk ik met plezier terug op de voorbije jaren. Bij jullie kon ik niet enkel terecht voor inhoudelijk advies, maar ook voor een gezellige babbel. Enkelen van hen verdienen een extra woordje van dank. Bram, jij was er van bij de start bij: bedankt om mijn mental coach te zijn. Annelies, jij was mijn (bureau)maatje van het eerste uur. Ik vind het fantastisch dat we samen nog een tripje naar Chicago kunnen maken. Uiteraard mogen de begijntjes niet ontbreken in dit rijtje. In de BHL slaagden we erin om het nuttige aan het aangename te koppelen. Hard werk werd afgewisseld met fijne middagpauzes (met te dure pasta's of soep), gezonde (of minder gezonde) vieruurtjes en gezellige drinks om verjaardagen te vieren of om het verlof goed in te zetten. Bedankt BHL'ers voor de leuke tijden!

Tijdens mijn doctoraat kon ik ook sterk terugvallen op een fantastische **onderzoeksgroep**, die sinds kort officieel luistert naar de naam 'Taal, leren, innoveren'. Ik ben blij dat ik deel mocht uitmaken van deze fijne groep en dat we elkaar konden helpen bij het uitvoeren van analyses, het opzetten van onderzoek en het uitwisselen van tips & tricks. Dit alles in combinatie met fijne uitstapjes en etentjes maakt onze onderzoeksgroep een inspirerende, warme en ondersteunende groep. Jessie, jij was mijn partner in crime tijdens onze (erro)R-periode en een goede raadgever. Emme, door onze gedeelde passie voor het meten en stimuleren van leerstrategieën kon ik bij jou terecht voor inspirerende gesprekken. Dank daarvoor en ook om zoveel meer te zijn dan een goede collega! Fien, jij bent een madam naar mijn hart: het hart op de juiste plaats en no nonsens! Liesje, bedankt voor jouw aangename gezelschap tijdens de verschillende congressen en jouw luisterend oor.

Een speciale dankjewel aan alle **directieleden, leerkrachten, leerlingen en studenten** die deelnamen aan mijn onderzoek. Bedankt voor de warme ontvangst, de tijd die jullie vrijmaakten om vragenlijsten in te vullen, en het beste van jullie zelf te geven tijdens de TutorBabbel-sessies. De nauwe samenwerking met de praktijk die ik dankzij jullie kon opbouwen, was een belangrijke motivatiebron voor mij.

Verder wil ik ook mijn **familie en vrienden** bedanken om me te steunen, gerust te stellen, even mijn gedachten te verzetten, terug aan te sporen, erover te praten (of er net over te zwijgen), om het geloof en vertrouwen die jullie in mij stelden, en nog zoveel meer… . Gaëtan, net zoals in het gewone leven, was jij tijdens mijn doctoraat mijn rots in de branding. Zoals de voorbije jaren, zorgde jij ook tijdens de afwerking van mijn doctoraat voor de nodige rust, ontspanning, relativeringsvermogen en - niet onbelangrijk - voor lekker eten. Elisa, mijn hartendiefje, jij bezit als enige de kunst om met één blik mijn 'doctoraatsbekommernissen' weg te toveren. Bedankt om me tijdens drukke momenten met jouw blinkende oogjes en ondeugend snoetje te verleiden om een pauze in te lassen!

Tot slot nodig ik jullie uit om verder te lezen en het resultaat te ontdekken van de voorbije zeven jaren. Ik hoop alvast dat ik hiermee jullie interesse voor zelfregulerend leren en student tutoring kan wekken.

Heusden, februari 2015
Sabrina

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1 General introduction

Some parts of this chapter are based on:

Vandevelde, S., Van Keer, H., & Rosseel, Y. (2013). Measuring the complexity of upper primary school children's self-regulated learning: A multi-component approach. *Contemporary Educational Psychology, 38*(4), 407-425. doi: 10.1016/j.cedpsych.2013.09.002

Vandevelde, S., Van Keer, H., & Merchie, E. (2014). The challenge of promoting self-regulated learning among primary school children with a low socio-economic and immigrant background. Manuscript accepted for publication in *Journal of Educational Research*.

Chapter 1
General introduction

Abstract

This introductory chapter provides a general overview of the research theme of the dissertation as a whole and the different empirical studies presented in chapter 2 to 6. After a general introduction on the central concepts and the accompanying research challenges, the research goals of this dissertation are outlined. In addition, the research design for addressing these goals is outlined. The introductory chapter concludes with an overview of the specific content of the chapters and their interrelationships, the methodological approaches applied in each study, and a visualization of the dissertation structure.

Introduction

In recent decades, Western society has been characterised by the rapid development of technology, an explosion of information and knowledge, and an increased value of knowledge (Anderson, 2008; Cornford, 2002). In an ever-changing knowledge-based society, continued learning through the lifespan is required in which citizens are expected to frequently update their skills and knowledge or learn new skills and knowledge (Bandura, 2006; Du Bois & Staley, 1997). Given the learning demands placed on citizens in the twenty-first century, lifelong learning is required to maintain knowledge and skill (Cornford, 2002).

Possessing self-regulated learning (SRL) skills is viewed as an important basis for the development of effective lifelong learning (Artelt, Baumert, McElvany, & Peschar, 2003; Cornford, 2002; Dignath, Buettner, & Langfeldt, 2008; Schunk, 2005; Zimmerman, 2002). SRL is not only seen as a process that facilitates the development of lifelong learning, but also facilitates students' effective performance in and outside academic settings (Artelt et al., 2003; Pintrich, 2004; Winne, 2005). Consequently, SRL has become an important educational goal and a valuable outcome of the schooling process in itself (e.g. Boekaerts, 1999; Claxton, 2007; Paris & Newman, 1990).

In the Flemish educational system, this is reflected in the cross-curricular 'learning to learn' attainment targets for both primary and secondary education. According to these cross-curricular targets, schools and teachers should adopt instructional methods across subjects and courses to encourage students to plan and organize their own learning, to identify, select and effectively apply learning strategies, to reflect on their performance and learning processes, and to nurture positive learning attitudes (Departement van Onderwijs en Vorming, 2008). Taken into account the recognized importance of SRL in educational policy and practice, and given the fact that recent scientific studies increasingly emphasise the promotion of SRL from primary education on, the present dissertation focuses on SRL among primary school students and the accompanying challenges to assess and foster these skills in this age group.

Self-regulated learning

Framing and conceptualisation

Theoretical perspectives and models regarding SRL

Since the emergence of SRL in educational research and educational psychology, it has been studied from different theoretical perspectives, ranging from more cognitive strategy oriented research in the 1970s, through metacognitive oriented research in the 1990s, to motivational and volitional oriented research more recently (Boekaerts & Corno, 2005; Paris & Paris, 2001; Zimmerman, 2001, 2011). Notwithstanding the fact that the various theoretical perspectives and models place different emphasis on the different components of SRL, theorists agree that SRL entails three main components, namely a metacognitive, a cognitive, and a motivational component (Dinsmore, Alexander, & Loughlin, 2008; Efklides, 2011; Hadwin, Wozney, & Pontin, 2005; Schraw, Crippen, & Hartley, 2006; Veenman, van Hout-Wolters, & Afflerbach, 2006; Zeidner, Boekaerts, & Pintrich, 2000; Zimmerman, 2008).

The *metacognitive component* refers to planning, setting goals, organising, self-monitoring, and self-evaluating at various points during the learning process (Boekaerts, 1999; Pintrich, 2004; Veenman, 2011b; Zimmerman, 1990). The *cognitive component* refers to various learning strategies and tactics students select and apply (Azevedo & Cromley, 2004; Boekaerts, 1999; Hadwin et al., 2005; Pintrich, 2004; Winne, 2001) and to how they select, structure, and create environments to optimise learning (Perry, Phillips, & Dowler, 2004; Zimmerman, 1990). A growing body of research has indicated that student's use of (meta)cognitive strategies is not merely a matter of skills, but also of motivation (Boekaerts, 1995; Pintrich, 1999; Wolters, 2003; Zimmerman & Moylan, 2009). Consequently, SRL involves an important *motivational component* as well, including intrinsic motivation, self-efficacy beliefs, task interest and self-attributions, as well as strategies to regulate motivation and affect (Pintrich, 2004; Wolters, 2003; Zimmerman, 2000; Zimmerman & Moylan, 2009).

It is argued that each of these three components is necessary, but not sufficient, for SRL (Schraw et al., 2006). For example, those who possess cognitive skills but are unmotivated to use them will not achieve the same performance as individuals who possess those skills and are motivated to use them (Zimmerman, 2000). Similarly, those who are motivated, but do not possess the necessary cognitive and metacognitive skills, often fail to achieve high levels of SRL. Further, it is generally assumed that these (meta)cognitive and motivational processes unfold through a forethought and planning phase, a performance phase, and reaction and reflection phase - in a cyclical way (Pintrich, 2004; Puustinen & Pulkkinnen, 2001; Wigfield, Klauda, & Cambria, 2011). In the literature, the way these components and phases of SRL are conceptually integrated and which components are more emphasised depends on the specific theoretical perspective.

Without being exhaustive, we will highlight some of the most prominent perspectives on and models of SRL (Panadero & Alonso-Tapia, 2014; Puustinen & Pulkkinnen, 2001). Historically, Bandura's social learning theory (Bandura, 1986) has guided extensive research on SRL (Zimmerman, 2001). From this theory, human functioning involves reciprocal interactions between behaviours, environmental variables, and personal variables (Schunk, 2001). This implies that human functioning, like SRL, is not only determined by personal processes, but these processes are assumed to be influenced by environmental and behavioural events in a reciprocal fashion (Zimmerman, 1989). Building on social learning theory, the *social cognitive perspective* defines SRL as "learning that results from students' self-generated thoughts, and behaviour that are systematically oriented toward the attainment of their learning goals" (Schunk, 2001, p. 125). Further, according to this perspective, three interacting key processes can be identified in SRL: self-observation (i.e., deliberate monitoring of one's activities prompting learners to self-evaluate), self-judgements (i.e., comparison of self-observed current performance level with one's learning goals), and self-reactions (i.e., one's behavioural, cognitive and affective responses to self-judgments) (Schunk, 2001).

Following social cognitive theory, Zimmerman's (2000, 2002) model views the structure of self-regulatory processes in terms of three cyclical phases: the forethought phase, the performance phase, and the self-reflection phase. The *forethought phase* refers to processes and beliefs that precede efforts to learn and is broken into two closely related categories of forethought processes: task analysis and self-motivation beliefs. Task analysis involves goal setting and strategic planning specific to the task and the setting. Self-motivation beliefs underlie forethought processes of goal setting and strategic planning and include self-efficacy beliefs, outcome expectations, intrinsic interest or valuing, and students' learning goal orientation. Although all self-motivational beliefs are important, self-efficacy (i.e., personal beliefs about one's own capabilities to learn or perform behaviour) is especially viewed as a key self-regulatory motive (Schunk & Ertmer, 2000).

The *performance phase* refers to processes occurring during learning efforts and is characterised by two types of processes: self-control and self-observation. Self-control involves the deployment of specific methods or strategies that were selected during the forethought phase, like self-instruction, attention focusing or task strategies (Zimmerman, 2002). Self-observation is defined as students' self-monitoring of their own performance, the conditions that surround it, and the effects that it produces (Zimmerman, 2000).

The final phase of Zimmerman's (2000) cyclical model is the *self-reflection phase*. This takes place after learning, wherein self-judgment (i.e., self-evaluating one's performance and attributing casual significance) and self-reaction (i.e., self-satisfaction, positive affect regarding one's performance and adaptive or defensive inferences) may affect forethought processes of subsequent learning events (Zimmerman, 2000). As such, the model reflects the interactive nature of the three self-regulatory processes (i.e., self-observation, self-judgements, and self-reactions).

From the *information-processing perspective*, SRL is described as a recursive cycle of control and monitoring processes that are used during different phases, namely defining the task, setting goals and planning, enacting tactics, and adapting metacognition (Winne, 2001). This perspective emphasises the cognitive processes and perceives metacognitive monitoring as the gateway to self-regulating one's learning (Greene & Azevedo, 2007; Winne, 1997). Winne and Hadwin's model (1998) is grounded in the information-processing perspective. This model is complex, but in essence they posited that learning occurs in four basic phases: (1) task definition, (2) goal setting and planning, (3) studying tactics, and (4) adaptations to metacognition. Within each phase of these phases, information processes result in information products. Those information products can have one of four possible topics: conditions, products, standards, and evaluations (Winne, 2001). Cognitive and task *conditions* are the resources available to the person and constraints inherent to the task. A *product* is new information created when information processes manipulate existing information during learning. These information processes, referred to as *operations*, include searching, monitoring, assembling, rehearsing, and translating. These processes result in cognitive products, while *standards* are the qualities that products are supposed to have (Winne, 2001). Finally, *evaluations* are created by monitoring and characterise the fit between standards and products. These evaluations can be created by the learners or provided from the environment. Using the acronym COPES (conditions – operations - products – evaluations – standards) they describe each of the four phases (i.e., task definition, goal setting and planning, studying tactics, and adaptions to metacognition) in terms of the interactions between a learners' condition, operations, products, evaluations and standards (Greene & Azevedo, 2007). For example, the product of phase one is a definition of a task, whereas the product of phase three might be a solution to a mathematics problem. These products are then compared to the standards by means of monitoring to determine whether phase objectives have been reached, or whether further actions are required. If there is a poor fit between products and standards, a learner may refine the product and/or revise the conditions and standards (Azevedo & Witherspoon, 2009).

From a more *motivational and volitional perspective*, Boekaerts has proposed a dual processing self-regulation model (i.e., the model of adaptable learning) (Boekaerts & Niemivirta, 2000). In short, this model assumes that students inherently self-regulate their behaviour in terms of two basic priorities (Boekaerts & Niemivirta, 2000). On the one hand, they pursuit self-chosen learning goals or goals that increase personal and academic resources (e.g., increasing competence in a domain). In this case, students follow the 'growth pathway' which is energised from the top down by motivation, such as personal interest, values, expected satisfaction, and rewards (i.e., top-down self-regulation) (Boekaerts & Corno, 2005). On the other hand, students who are primarily concerned with their well-being initiate activity in the 'well-being pathway', in which they seek to maintain available resources and prevent loss, damage and distortions of well-being (Boekaerts & Niemivirta, 2000). By doing this, they focus on cues in the learning environment that signal unfavourable learning conditions, obstacles, and drawbacks. At such a point, they use energy to prevent (further) negative events from occurring (i.e., bottom-up self-regulation).

A search for well-being implies that students are more concerned with maintaining or restoring positive feelings than with the pursuit of growth goals. It is assumed that students can switch back from the well-being pathway to the growth pathway by using volitional strategies (Boekaerts & Corno, 2005). As such, volitional strategies, such as time and resource management or prioritising goals (Corno, 2001) can help students to stay on the growth pathway (i.e., volitional strategy use supports top-down self-regulation) and get off the well-being track when a stressor blocks learning (i.e., volitional strategy use to recover from maladaptive forms of bottom-up self-regulation and to support the environmental cues that lead to adaptive forms of bottom-up self-regulation) (Boekaerts & Corno, 2005). In sum, according to this model, students struggle to balance growth and well-being goals. Depending on how students manage their goals and emotions, their self-regulation can be top-down (related to growth goals) or bottom-up (related to well-being goals).

The theoretical framework of Pintrich: An overarching view

Although the different models of SRL may outline different key facets and phases of SRL and vary in the ways these facets and phases are conceptually integrated, Pintrich (2000) states that they share some basic assumptions about learning and regulation. The first assumption involves the *active and constructive nature of learning,* viewing learners as active, constructive participants in the learning process. This implies that learners are assumed to construct their own meanings, goals, and strategies from the available information in the 'external' environment and from information in their own minds (the 'internal' environment). A second, but related, assumption refers to *learners' potential for control,* assuming that learners can potentially monitor, control, and regulate aspects of their own cognition, motivation, and behaviour as well as features of the learning environment. While acknowledging that some monitoring, control and regulation is possible, this assumption also takes account of the fact that not all individuals will or can monitor and control their cognition, motivation, or behaviour at all times and contexts. The *goal, criterion, or standard assumption* is the third general assumption. Pintrich (2000) asserts that all models of SRL assume that there is some type of criterion, standard, or goal against which comparisons are made in order to assess whether the process should continue as is or whether some type of adjustment is required. As such, learners can set themselves standards or goals, monitor their progress toward these goals, and then adapt and regulate their cognition, motivation, and behaviour to attain their goals. Finally, most models of SRL view *self-regulatory activities* as *mediators* between personal and contextual characteristics and actual achievement or performance. In the light of this assumption, it is argued that achievement is not just linked to learners' cultural, demographic, and personal features or the contextual characteristics of the classroom environment, but that learners' self-regulation of cognition, motivation, and behaviour mediate the relationships between the person, context and achievement (Pintrich, 2000, 2004).

Given these assumptions, Pintrich (2000) defines SRL as "an active, constructive process whereby students set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behaviour, guided and constrained by their goals and the contextual features in the environment" (p. 453). In accordance to this definition, Pintrich developed a conceptual framework classifying different phases and areas of regulation. The four phases are processes that many models of SRL share and they reflect (a) forethought, planning, and activation; (b) monitoring; (c) control; and (d) reaction and reflection (Pintrich, 2004). These planning, monitoring, control, and regulation processes reflect the metacognitive component of SRL and can be applied to four areas, namely cognition, motivation, behaviour, and context. By integrating the general assumptions and features of the different models, Pintrich (2000, 2004) provides a coherent framework to guide research on SRL. Moreover, the framework reflects the phased structure of SRL processes and the multicomponent character of SRL. Therefore, the framework of Pintrich (2000) is used in the present dissertation as the main theoretical framework to define SRL and to underpin the empirical studies. A more detailed description of the model is provided underneath.

According to Pintrich's model (see Table 1), cognitive planning and forethought activities include setting goals for learning and activating prior knowledge about the material, as well as activating any metacognitive knowledge students have about the task or themselves (Pintrich, 2000). In accordance with these activities, learners can engage in time and effort planning (i.e., behaviour). Motivational aspects during this preparatory phase involve goal orientation (i.e., purpose for engaging in task), self-efficacy (i.e., judgments of competence about their capabilities to learn or perform specific tasks), perceptions of task difficulty and task value beliefs (e.g., beliefs about the importance, utility, and relevance of the task), and personal interest in the task (e.g., liking of content area, domain) (Pintrich, 2004). Contextual planning refers to students' perceptions of the task and context (Pintrich, 2000).

As the task evolves, self-regulated learners will monitor their cognition, behaviour, motivation and the context. Cognitive monitoring involves the awareness and monitoring of various aspects of cognition, such as judgements of learning and feelings of knowing. Motivational monitoring refers to being aware of one's motivational beliefs and affect. While monitoring of behaviour embraces time and effort management, contextual monitoring refers to monitoring task conditions to determine whether they are changing. These monitoring activities provide the learner with information about the relative discrepancy between a goal and the current progress towards that goal and with information about the necessity of changing strategies (Pintrich, 2000).

Based on their monitoring activities, learners will attempt to control their cognitions, motivation, behaviour, and contextual factors to enhance learning. One of the central aspects of cognitive control and regulation is the actual selection and use of various cognitive and learning strategies, such as rehearsal, elaboration, and organisational strategies (Weinstein & Mayer, 1986). Students not only regulate their cognition but also their motivation through, for instance, the use of positive self-talk, by promising themselves rewards, by trying to make it more interesting or by increasing the task value. In all these cases, students attempt to change or control their motivation in order to complete a task that might be boring or difficult (Wolters, 2003). Regarding behaviour, students can increase or decrease their effort and seek help when needed. Another aspect of behavioural control includes general persistence. Strategies to make the context more conducive to learning, for example eliminating or reducing distractions, are regarded as contextual control (Pintrich, 2004).

Finally, in terms of reaction and reflection, self-regulated learners can make judgments and evaluations of their performance on the task, reflections on their cognitive processing, as well as adaptive attributions for their performance. Besides these cognitive reflections, students may also have emotional reactions (e.g. happiness, pride, sadness) regarding the outcomes. In terms of behavioural reaction and reflection, students can reflect on their effort and time management. Regarding context, students can make general evaluations of the task or classroom environment (Pintrich, 2000).

While the abovementioned framework provides a theoretical perspective on SRL, in the subsequent sections we review empirical literature on SRL among primary school children.

Table 1

Phases and areas of self-regulated learning according to the Model of Pintrich (2004, p. 390)

	Areas of regulation			
Phases	Cognition	Motivation/affect	Behaviour	Context
Forethought, planning, and activation	Target goal setting Prior content knowledge activation Metacognitive knowledge activation	Goal orientation approach Efficacy judgements Ease of learning judgements, perceptions of task difficulty Task value activation Interest activation	Time and effort planning Planning for self-observation of behaviour	Perceptions of task Perceptions of context
Monitoring	Metacognitive awareness and monitoring of cognition (FOKs, JOLs)	Awareness and monitoring of motivation and affect	Awareness and monitoring of effort, time use, need for help	Monitoring changing task and context conditions
Control	Selection and adaptation of cognitive strategies for learning, thinking	Selection and adaptation for managing motivation and affect	Increase/decrease effort Persist, give up Help-seeking behaviour	Change or renegotiate task Change or leave context
Reaction and reflection	Cognitive judgements	Affective reactions	Choice behaviour	Evaluation of task Evaluation of context

Self-regulated learning in primary education

The occurrence of SRL in young children

Originally, research on SRL was dominated by a focus on secondary or higher education students (Winne & Perry, 2000), due to the long-held belief that young children were unable to self-regulate their learning (Schunk, 2001; Zimmerman, 2001). This belief was nourished by different claims. First, it was argued that children's egocentrism was a crucial factor limiting self-regulation of learning (Zimmerman, 2001). From a Vygotskian or social cultural perspective, young children's inability to use language covertly to guide functioning was stressed as an obstacle to SRL (Paris & Newman, 1990; Zimmerman, 2001). Further, it was thought that young children's tendency to view ability in incremental terms, to be overly optimistic about their ability, and to have an expectation that trying hard is sufficient to ensure success, undermined SRL (Paris & Newman, 1990; Zimmerman, 1990).

More recently, however, these assumptions have been challenged as a growing body of research provides evidence that young children can and do engage in various SRL activities (e.g., Annevirta & Vauras, 2006; Bronson, 2000; Larkin, 2006; Neuenhaus, Artelt, Lingel, & Schneider, 2011; Perry et al., 2004; Schneider & Lockl, 2002; Whitebread et al., 2009; Wigfield et al., 2011). Given the complex and multi-faceted nature of SRL, developmental research has often focused on specific aspects of SRL. For example, studies based on metacognitive self-judgments have shown that preschool children are already able to evaluate their knowledge and learning achievement on very simple and familiar tasks. In this respect, Schneider and Lockl (2002) show that young children's predictions of tasks' difficulty level (i.e., ease-of-learning judgments) and their ability to provide delayed judgments of learning are quite accurate and that these abilities increase as they proceed through primary education.

A broader scope on metacognitive aspects of SRL was adopted in the research of Perry and colleagues (Perry & VandeKamp, 2000; Perry, VandeKamp, Mercer, & Nordby, 2002), finding that young children display planning, monitoring, and evaluating behaviour when engaging in complex, multifaceted tasks. Similarly, Whitebread et al. (2009) found that 3- to 5-year-old children already performed basic forms of planning, monitoring, and reflection when the task was appropriate to their interest and level of understanding.

By studying the motivational strategies of primary school children, Cooper and Corpus (2009) focused on the motivational component of SRL, indicating that children's understanding of effective motivational strategies increased throughout primary school. Research on cognitive learning strategy use generally reveals that children's strategy use seems to shift from lower-level strategies to deeper processing strategies and to an increasing use of multiple strategies with increasing age (Alexander, Graham, & Harris, 1998; Kron-Sperl, Schneider, & Hasselhorn, 2008).

In sum, it can be argued that during preschool or early-school years children display elementary forms of SRL and that these strategies become more sophisticated and academically oriented over later primary school years and their onward school career (Bronson, 2000; Pintrich & Zusho, 2002; Schneider, 2008; van der Stel & Veenman, 2010; Veenman & Spaans, 2005; Veenman et al., 2006). However, the need for further research regarding this matter has been stressed (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013; Shamir, Mevarech, & Gida, 2009), but also is complicated by the shortage of appropriate measurement instruments to assess primary school children's SRL (Whitebread et al., 2009; Winne & Perry, 2000).

The transition to secondary education: A critical period for SRL

It is argued that SRL and the promotion of SRL becomes increasingly important in transition periods during students' educational career, such as the transition from primary to secondary education (Cleary & Chen, 2009; Cleary & Zimmerman, 2004; Dembo & Eaton, 2000). Whereas primary education is generally characterised by a more closely monitored environment, secondary education is typified by increased expectations for academic productivity and independent study time, management of different assignments from multiple teachers, more intensive instruction, and a greater emphasis on performance and social comparisons (Cleary & Zimmerman, 2004; Duchesne, Ratelle, & Roy, 2012; Dunlosky et al., 2013; Usher & Pajares, 2006; Wigfield & Eccles, 2002; Wigfield, Byrnes, & Eccles, 2006; Wingate, 2007). To handle these increased expectations and the changing learning environment, it is expected that students develop a broader and more sophisticated repertoire of self-regulatory learning strategies which they can access and utilize when confronted with more complex study requirements (Cleary & Zimmerman, 2004; Cornford, 2002; Grolnick, Kurowski, & Gurland, 1999; Hamman, Berthelot, Saia, & Crowley, 2000; Meneghetti, De Beni, & Cornoldi, 2007). Paradoxically, many students simultaneously develop negative self-motivational beliefs (e.g., decreasing self-efficacy beliefs regarding their SRL) or show a decline in motivation when they transition to secondary school (Corpus, McClintic-Gilbert, & Hayenga, 2009; Eccles, 2005; Gottfried, Fleming, & Gottfried, 2001; Hornstra, van der Veen, Peetsma, & Volman, 2013; Pajares, 2002; Spinath & Spinath, 2005; Usher & Pajares, 2008; Wigfield & Eccles, 2002). This is worrisome, because as students lose motivation for and confidence in their self-regulated learning strategies and practices, they are less likely to employ them and will struggle to deal with more demanding and challenging learning environments (Cleary & Zimmerman, 2004; Usher & Pajares, 2008).

These findings underline the significance of promoting SRL in primary education rather than leaving it until later (Dignath & Büttner, 2008; Perry et al., 2004; Postholm, 2010; Stoeger & Ziegler, 2011), in order to prevent children from developing negative and counterproductive learning habits and beliefs (Dignath & Büttner, 2008; Donker, de Boer, Kostons, van Ewijk, & van der Werf, 2014; Perry et al., 2004) and help them to undertake the transition as more pro-active and self-regulated learners. In line with this and taking into account the premise that early adolescence represents a critical moment for the establishment and promotion of a good study method (Cornford, 2002; Meneghetti et al., 2007), the present dissertation focuses on late primary education, and more specifically on fifth and sixth graders, since at this age children are approaching the transition from primary to secondary school in Flemish education.

SRL, a desirable but challenging goal for students

The importance of stimulating SRL from an early age on is supported by the fact that a substantial group of students encounter difficulties applying self-regulatory learning strategies in an effective and efficient way (Azevedo, Moos, Greene, Winters, & Cromley, 2008; Pintrich, 2002, 2004; Randi & Corno, 2000; Schunk & Ertmer, 2000; Winne & Nesbit, 2009) and that the use of self-regulated learning strategies varies among learners (Annevirta & Vauras, 2006; Perry et al., 2004; Ponitz et al. 2008; Winne, 2005; Zimmerman, 2002). Research indicates that in many cases SRL does not develop spontaneously and that additional training and instruction is needed to initiate, improve, or sustain these desirable skills (Askell-Williams, Lawson, & Skrzypiec, 2012; Boekaerts, 1997; Desoete, 2008; Schneider, 2008; Schunk & Ertmer, 2000). This should ideally be provided on a continuous basis, starting from primary education (Dignath et al., 2008; Willoughby, Porter, Belsito, & Yearsley, 1999).

In general, two main classes of deficiency might impede the use of self-regulatory learning processes (Bannert & Mengelkamp, 2008; Veenman, 2011b). First, learners suffering from an *availability deficiency* display a poor level of self-regulation because they do not possess the necessary knowledge and skills to perform the self-regulatory strategies (Veenman et al., 2006). Learners with a *production deficiency*, on the other hand, do have the skills at their disposal, but do not spontaneously execute them due to various reasons (Veenman, 2011b), such as not knowing when to enact a particular strategy, not recognizing the relevance and utility of these skills, or not sufficiently desiring a particular goal or outcome to be motivated to display the more demanding SRL strategies (Veenman et al., 2006; Winne & Nesbit, 2009; Zimmerman, 2001, 2011). For the latter learners, additional prompting and cueing might be sufficient to improve their SRL, whereas learners with an availability deficiency need more extensive training alongside prompting and practice opportunities (Veenman, 2011b). While many students struggle with effectively and efficiently regulating their learning, for some students SRL is an even more challenging endeavour, like for students with learning disabilities or students from a disadvantaged background (Brody & Flor, 1998; Bryan, Burstein, & James, 2001; Butler, 1998; Cartier, Butler, & Bouchard, 2010; Desoete, 2009; Graham, Harris, & Mason, 2005; Händel, Lockl, Heydrich, Weinert, & Artelt, 2014; Jokic & Whitebread, 2011; Lichtinger & Kaplan, 2015; Zimmerman, 2000).

SRL of students with a low socio-economic and/or immigrant background

In this dissertation, we specifically focus on students from a low socio-economic and/or immigrant background, which is an underexplored target group in SRL research. For Flanders (Belgium), the PISA results show a strong relationship between student performance and socio-economic background. Although Flanders has high average performance levels, student performance is strongly related to socio-economic background. Furthermore, Flanders shows one of the largest disparities between native students and immigrant students (Jacobs, Rea & Teney, 2009; OECD, 2004, 2006, 2013; Park & Sandefur, 2010; Sierens, Van Houtte, Loobuyck, Delrue, & Pelleriaux, 2006). This pattern of underperformance is echoed in the patterns of enrolment of Flemish students from lower socio-economic and/or immigrant backgrounds (Groenez, Van den Brande, & Nicaise, 2003). In comparison with their more privileged peers, these children are less enrolled in pre-primary education, more frequently encounter educational delay at primary and secondary level, are over-represented in technically and vocationally oriented programmes, and drop out more frequently. Moreover, these students are underrepresented in higher education. Unfortunately, research shows that for these students school experiences too often reinforce rather than mitigate the influence of student background, stressing the need to identify initiatives to achieve a more equitable distribution of educational opportunities.

Although research specifically focusing on SRL among specific groups of students is scarce (Pintrich & Zusho, 2007; Zeidner et al., 2000), students from socio-economically disadvantaged backgrounds have been found to show less SRL behaviour and encounter difficulties in developing effective SRL behaviour (Cartier et al., 2010; Cartier, Butler, & Janosz, 2006; Howse, Lange, Farran, Boyles, 2003; Pappas, Ginsburg, & Jiang, 2003). Students from a low socio-economic background and ethnic minority students also have more difficulty engaging in motivated behaviour and investing effort in school towards the end of primary school (Hornstra, 2013; Vandevelde & Van Keer, 2014). In this respect, research documents that interventions on SRL are helpful to compensate and handle the self-regulatory dysfunctions that struggling learners experience (Zimmerman, 2000).

The disadvantaged educational position of Flemish students from low socio-economic and/or immigrant backgrounds and the greater need for additional support regarding SRL, combined with the premise that SRL can improve students' learning and performance (Boekaerts, Pintrich, & Zeidner, 2000; Hattie, 2009), motivated our focus on this target group. How SRL can be promoted, is elaborated on in the next sections.

Promotion of self-regulated learning

Levels in the development of SRL

A first step in understanding how SRL can be stimulated is knowing how SRL develops. Zimmerman and his colleagues formulated a social cognitive model of the development of self-regulatory competence entailing four levels (Schunk, 2001; Zimmerman, 2001). At the first *observational level*, novice learners acquire skills and strategies by distinguishing the major features of a model's skill or strategy. Leaners' motivation to develop the skill or strategy further will depend on the perceived similarity to a model and vicarious consequences of a model's use of this skill or strategy. Despite the value of this vicarious information, it is often insufficient to lead to incorporation of the skill or strategy into learners' behavioural repertoires. Most learners also need to perform the strategies personally and require practice with feedback to begin to develop the skills (Zimmerman, 2000). A second or *emulative level* is attained when a learner's performance approximates the general form of model's skill or strategy (Zimmerman, 2001). The learner seldom exactly copies the actions of the model, rather he/she emulates the general pattern or style of functioning. For example, learners will adopt the type of questions a model asks instead of the exact words (Schunk, 2001; Zimmerman, 2000). In this phase, guidance, feedback, and social reinforcement during practice are important to improve learners' accuracy in performing a particular skill or strategy (Zimmerman, 2000). The first two levels are distinctive as the first level involves acquisition only at an observational level, whereas emulative learning also includes a performance capability (Schunk, 2001). A third or *self-control level* of self-regulation occurs when students master the use of a skill in structured settings without the presence of models. At this stage, learners' use of a skill or strategy is based on mental representation of a model's performance rather than on an overt social referent (Zimmerman, 2000). The hallmark of the final *self-regulation level* is the capability of learners to adapt their skills and strategies systematically to changing personal and contextual conditions (Schunk, 2001). Although learners achieving this self-regulation level have the competence to perform self-regulatory strategies, they may not choose to do so because of motivational or contextual factors as discussed above. According to Zimmerman (2000), a growing body of evidence indicates that the pace and quality of learners' SRL can be enhanced significantly if learners proceed according to this developmental hierarchy.

In summary, from a social cognitive perspective, the development of SRL starts with the most extensive social guidance at the first level, and this social support is systematically reduced as learners acquire the self-regulatory skills. So, in general, a learner's acquisition of SRL is typified by a shift from reliance on primarily social sources (i.e., first two levels) towards reliance on self-sources (i.e., last two levels) (Schunk, 2001; Zimmerman, 2000, 2001). It must, however, be emphasised that although self-controlled and self-regulated learners use social sources less frequently, they nonetheless continue to rely on them, but on a more self-selective basis. This implies that self-regulation does not mean complete social indepence (Schunk, 2001). A key pedagogical issue regarding socially initiated self-regulatory training, however, is when to withdraw the various forms of modelling support (Zimmerman, 2000).

General instructional principles for promoting SRL in education

As mentioned previously, in most cases SRL does not develop automatically nor is it acquired passively from the environment (Schunk, 2001; Winne, 2005). Research, however, indicates that SRL can be fostered by targeted interventions and instruction, even from primary education on (Dignath et al., 2008; Paris & Paris, 2001; Perels, Gürtler, & Schmitz, 2005; Schneider, 2008; Stoeger & Ziegler, 2008; Zimmerman, Bonner, & Kovack, 2002). Based on the literature, three general guidelines can be described regarding how to support students in their acquisition of SRL.

First, as described above, from a social cognitive perspective, it is advisable to move from extensive social guidance towards self-regulation by subsequently and systematically reducing the social sources, also referred to as *modelling-scaffolding-fading* technique (Schunk, 2001; Winne, 2005; Zimmerman, 2002). Translated to educational settings, this implies that a shift is needed from teachers doing the regulating by providing direct instruction and modelling towards situations wherein students increasingly rely on internal standards, self-reinforcement, self-regulatory processes, and self-efficacy beliefs (Hadwin et al., 2005). This shift is also reflected in a social-cultural approach towards the appropriation of SRL. In this perspective, the process of developing SRL is described in terms of internalization; individual self-regulatory processes reflect the gradual internalization of social practices in the classroom (Perry & Rahim, 2011; Zimmerman, 2001). SRL begins at an interpersonal level in which adults model activities. Over time, as they begin to understand how self-regulating activities relate to one another, students begin to imitate or take on parts of the activity. Eventually, through the mediation of inner speech, children can exersice SRL at an intrapersonal level (Hadwin et al., 2005; Zimmerman, 2001).

In sum, regardless of the specific social perspective, there seems to be consensus that through a phase of co-regulation a shift from external regulation towards students taking control and demonstrating self-regulatory competence will occur. During external regulation, learners are primarily expected to observe as the teacher demonstrates the use of strategies and verbalises their thought processes (Hadwin et al., 2005; Kistner et al., 2010; Zimmerman, 2000). Co-regulation is perceived as a transitional phase in learners' acquisition of SRL and refers to the process by which teachers provide meaningful opportunities and responsive scaffolding for learners to practice and acquire SRL strategies (Hadwin, Oshige, Gress, & Winne, 2010; Perry & Rahim, 2011). For example, during co-regulation, the learner may focus on task performance (e.g., by making a summary) while a more capable other (e.g., teacher) supports his regulatory control by means of multiple strategically placed metacognitive and motivational prompts (Perry & Rahim, 2011). In order to evolve from external regulation to self-regulation, scaffolding is indispensable and is a main process in the co-regulation phase (Hadwin et al., 2010; Hadwin et al., 2005; Puntambekar & Hübscher, 2005). Scaffolding has been described as assisting other learners within their zone of proximal development and providing temporary support so that learners can complete a task which would otherwise be too difficult (van de Pol, Volman, & Beishuizen, 2010). Successful scaffolding is typified by an interactive process, the presence of a shared understanding of the activity, calibrated support based on an ongoing diagnosis of the students' knowledge and skills, and contingent fading to gradually transfer the responsibility for learning towards the student (Puntambekar & Hübscher, 2005; van de Pol et al., 2010). This support is individualised not only for different learners with various levels of prior knowledge and skills, but also changes for each learner over a particular task (Puntambekar & Hübscher, 2005).

Second, besides modelling-scaffolding-fading, teachers can also stimulate SRL in an indirect way by creating a *supportive learning environment* that enables students to engage actively in their learning process (Kistner et al., 2010; Perry et al., 2004). Such a powerful environment gives students the opportunities to seek challenges, to take responsibility, to reflect on their progress and to practice SRL in order to deepen and maintain SRL over time (Paris & Paris, 2001). Based on their studies focusing on naturally occurring activities in primary school classes, Perry and colleagues identified several features of high-SRL classroom practices. Concretely, these practices were characterised by providing students opportunities to: (a) engage in complex, meaningful activities that extend over multiple sessions; (b) make choices in terms of what to work on, where, and with whom; (c) control challenge by deciding, for example, how much to write, at what pace, and with what level of support; and (d) be involved in setting evaluation criteria and reviewing and reflection on their learning. Moreover, teachers in high-SRL classrooms acted as co-regulating agents of their students' self-regulation by providing just enough and just in time information and support to facilitate students' acquisition and application of SRL (Perry, 1998; Perry et al., 2004; Perry & VandeKamp, 2000; Perry et al., 2002).

Third, although both modelling-scaffolding-fading and creating powerful learning environments are important to enhance students' SRL, they are mostly not sufficient. In these cases, *explicit instruction* of strategies is needed, especially for low achievers and for students who encounter more difficulties with SRL (Cooper & Corpus, 2009; Kistner et al., 2010; Paris & Paris, 2001; Weinstein, Husman, & Dierking, 2000). During explicit instruction, teachers not only model the strategies, but also provide specific strategy information so that students become aware of the how, when, and why to apply strategies (Kistner et al., 2010; Paris & Paris, 2001; Veenman et al., 2006). More concretely, in line with the WWW&H rule (What to do, When, Why, and How) (Veenman et al., 2006), it is preferable to focus on declarative knowledge (i.e., knowing about a variety of strategies), procedural knowledge (i.e., knowing how to use strategies), and conditional knowledge (i.e., knowing when or when not to use particular strategies) during explicit instruction (de Boer, Donker-Bergstra, Kostons, Korpershoek, & van der Werf, 2012; Weinstein et al., 2000; Weinstein, Jung, & Acee, 2011). Such instruction also contributes to the transfer of strategy application in subsequent situations (Kistner et al., 2010).

Ideally, the above described guidelines to promote SRL are combined by (a) introducing self-regulated learning strategies by modelling, (b) providing explicit instruction so students are informed about the significance of a strategy and about how to employ, monitor, and evaluate a strategy, and (c) providing various practice opportunities by creating powerful learning environments accompanied by close guidance and feedback to optimise students' self-regulated learning strategies and by reducing support as students' proficiency in SRL increases (Pressley & Woloshyn, 1995).

Guidelines for interventions aiming at the promotion of SRL

As an extensive body of research highlights the importance of stimulating SRL and simultaeously indicates that SRL is trainable, SRL has become a popular area for educational intervention. In past decades, numerous studies and self-regulation training programmes were set up and different approaches were examined across educational levels: classroom-based training (e.g., Perels, Dignath, & Schmitz, 2009; Stoeger & Ziegler, 2008), computer-based training (e.g., Graesser, McNamara, & VanLehn, 2005; Kramarski & Gutman, 2006), and school-based programmes (e.g., Cleary & Zimmerman, 2004). By reviewing this intervention research and meta-analyses, the abovementioned guidelines can be supplemented with some additional characteristics of effective SRL interventions (Dignath & Büttner, 2008; Donker et al., 2014; Hattie, Biggs, & Purdie, 1996). These guidelines were also taken into account when setting up the intervention studies in this dissertation.

First, it is important that an intervention reflects the multicomponent character of SRL and combines different types of strategies instead of separately training selected components of SRL (De Corte, Mason, Depaepe, & Verschaffel, 2011; Dignath & Büttner, 2008; Leopold, den Elzen-Rump, & Leutner, 2007; Schunk & Ertmer, 2000).

Second, based on meta-analysis, Dignath-van Ewijk (2011) found that interventions are more effective for primary school students when they are based on social-cognitive theories, indicating that intervetions at this educational level should take into account students' need for encouragement and motivational support.

Further, SRL instruction is more succesful if the instruction is embedded in the context of specific tasks to ensure connectivity (Alexander, Dinsmore, Parkinson, & Winters, 2011; Hattie et al., 1996; Veenman et al., 2006; Weinstein et al., 2000; Whitebread & Pino Pasternak, 2010). Similarly, it is stressed that students need ample opportunities to practice using the targeted strategies on authentic tasks (Weinstein et al., 2000).

A subsequent general principle refers to prolonged training (Pressley, Graham, & Harris, 2006; Veenman, 2011b). Although opinions differ about the preferred length of instruction, it can generally be stated that a relatively short instruction period might be sufficient when targeting a limited set of SRL strategies, but that a longer period will be necessary for the establishment of enduring effects on spontaneous strategy use (de Boer et al., 2012; Veenman, 2011b).

Finally, as previously mentioned, it is increasingly argued that promoting SRL is important in primary education, and more specifically in late primary education as students approach the transition towards secondary education. In line with this, it is also believed that students will be more receptive to training early in their schooling rather than when students have already developed disadvantageous learning styles and learning behaviour (Dignath & Büttner, 2008; Donker et al., 2014; Hattie et al., 1996; Perry et al., 2004). These research findings not only indicate that SRL is trainable, but also provides several implications for educational practice. The subsequent question is how and to what exent these instructional principles and guidelines are integrated in daily classroom practice.

The prevalence of SRL in daily classroom practice

Notwithstanding the consensus that SRL in an important educational goal and that teachers can play an important role in stimulating it (Boekaerts, 1997; Dembo & Eaton, 2000; Hamman et al., 2000), research shows that across educational levels external regulation largely prevails over self-regulation (Boekaerts, 1997; Cornford, 2002; De Corte et al., 2011 ; Pintrich, 2002; Zimmerman, 2002) and that teachers stimulate SRL only to a limited extent (Bolhuis & Voeten, 2001; Hamman et al., 2000; Hendy & Whitebread, 2000; Lombaerts, Engels, & Vanderfaeillie, 2007; Vandevelde, Vandenbussche, & Van Keer, 2012) or primarily promote SRL in an indirect way (Kistner et al., 2010; Moos & Ringdal, 2012; Vandevelde, Roose, Dhuyvetter, & Van Keer, 2015). Further, although especially young children and struggling learners seem to profit from more close and individualised guidance to refine their self-regulated learning processes (Zimmerman, 1990), teachers encounter different constraints to tailor instruction to each student's needs in increasingly diverse classrooms (Butler, 2002; King, 1997; Meyer & Turner, 2002; Vandevelde et al., 2012; Wood & Tanner, 2012) and scaffolding is found to be rare in classroom practice (van de Pol, Volman, & Beishuizen, 2011).

Moreover, teachers of disadvantaged students seem to opt more frequently for teacher-centred learning environments, partly due to their belief that their students lack the characteristics necessary for more innovative and autonomy-supportive learning environments (Cartier et al., 2010; Hornstra, Mansfield, Van der Veen, Peetsma, & Volman, in press). Consequently, students from ethnic minorities or socio-economically disadvantaged backgrounds may be more accustomed to traditional ways of teaching, which are less in line with conditions promoting SRL. However, these students actually require more instruction and practice in SRL (Bolhuis & Voeten, 2001; Dembo & Eaton, 2000; Pressley & Gaskins, 2006; Veenman & Verheij, 2003; Weinstein et al., 2000), as they have less experience and prior knowledge about effective strategies (Dembo & Eaton, 2000; Larkin, 2009).

To conclude, in promoting SRL, especially among younger students and students at risk of educational failure, close and individualised guidance seems to be preferable to refine their self-regulatory processes (Butler, 2002; Veenman et al., 2006). However, teachers experience serious constraints in providing such support during daily classroom practice. Student tutoring, which may feature a higher degree of individual help, might be a promising method. Notwithstanding that different approaches and interventions have previously been studied, to our knowledge, the potential of enhancing SRL by means of student tutoring has not yet been explored.

Student tutoring

Framing and conceptualisation

Tutoring has a long history. A few decades ago tutoring attracted renewed interest, as changing socio-economic conditions created increasing concern for the future of poorly educated citizens. As the effectiveness of tutoring has been documented extensively, tutoring remains a popular form of instruction worldwide and across diverse domains, student populations, and contexts (Cohen, Kulik, & Kulik, 1982; Falchikov, 2001; Gordon, Morgan, O'Malley, & Ponticell, 2007; Topping, 2005). One of the longest established and most intensively researched forms of tutoring is peer tutoring (Topping, 2005). In contrast, student tutoring is a less known and researched format of tutoring.

Student tutoring is a specific type of tutoring and is described as "the practice of having students from universities and colleges tutor pupils in primary and high school classrooms under the guidance of the class teacher" (Topping & Hill, 1995,p. 15). Within the terminology of tutoring, the more capable, knowledgeable and experienced student with a supportive role is called the *tutor*, whereas the *tutees* are less experienced pupils receiving help (Graesser, D'Mello, & Cade, 2011; Topping & Hill, 1995). Student tutoring is often confused with 'peer tutoring', which is defined as "people from similar social groupings who are not professional teachers helping each other to learn, and learning themselves by teaching" (Topping, 1996, p. 322). The term 'peer' implies equality of age and position. Within peer tutoring, the tutor (i.e., the student taking a supportive role) and tutee (i.e., the student receiving help and support) can be from the same class (i.e., same-age peer tutoring) or a different class (i.e., cross-age peer tutoring). In the case of student tutoring, however, the tutor (i.e., a student from higher education) and tutee (i.e., a student from primary or secondary education) have a different educational level and differ more in age and status position compared to peer tutoring.

Historically, student tutoring was mainly used as a cost-effective solution for students who were not achieving expected grades and educational standards. Across countries, the expansion of these tutoring programmes has been fuelled by substantial federal, state, and local monies to programs. In the United Kingdom, for example, the Imperial College/British Petroleum International Mentoring and Tutoring Project greatly supported student tutoring and mentoring initiatives (Goodlad, 1995). In the United States, the prevalence of tutoring programmes has accelerated due to the America Reads Challenge, a nationwide tutoring initiative. Later, the No

Child Left Behind Act of 2001 provided further impetus for setting up tutoring programmes (Gordon et al., 2007; Ritter, Barnett, Denny, & Albin, 2009). In Flanders (Belgium) the practice of having university or college students supporting school-aged children's learning processes is a rather new phenomenon. In the Flemish educational field, student tutoring is mainly intended to enhance the educational opportunities of students with low socio-economic and/or immigrant background (De Backer & Van Keer, 2008) and was encouraged by the King Baudouin Foundation in an initial phase. By promulgating a decree regarding subsidising student tutoring initiatives, student tutoring has received a more formalised place within the Flemisch educational field.

In practice, the implementation of student tutoring programmes is typified by great variety, both in the international and in the Flemish context (De Backer & Van Keer, 2008; Gordon et al., 2007; Topping & Hill, 1995). This variation can be captured according to a number of dimensions.

First, *tutees* with different characteristics are enrolled in student tutoring programmes. As mentioned above, in most cases tutoring programmes have a remedial or preventive goal. Consequently, tutoring instruction is often directed at students who struggle with learning (e.g., learning delayed, socio-economically disadvantaged, minority students, drop-out risk) (Gordon et al., 2007; Topping & Hill, 1995). The focus on students at risk for academic failure is also reinforced by the finding that tutoring has proven to be beneficial for these learners (Fitzgerald, 2001; Fuchs et al., 2008; Hock, Pulvers, Deshler, & Schumaker, 2001; Morris, 2006; Rohrbeck, Ginsburg-Block, Fantuzzo, & Miller, 2003; Slavin, Lake, Davis, & Madden, 2011; Vadasy, Jenkins, Antil, Wayne, & O'Connor, 1997).

In the case of student tutoring, *tutors* are not professional tutors or regular school teachers, but students from higher education with diverse backgrounds and academic orientations. They can be engaged as community volunteers taking up the tutoring role voluntarily or with modest payment. In other cases the tutoring assignment is a formal part of their study programme and rewarded with course accreditation or credits (e.g., pre-service teachers) (Bossaerts, 2007; Gordon et al., 2007; Topping & Ehly, 2001; Topping & Hill, 1995).

Regarding *contact arrangements,* tutoring has occurred in one-to-one or group settings. Group settings range from 2 to 30 (the latter being a full class). Correspondingly, student tutoring programmes are also organised at different *times* (e.g., during regular class time, recess time, after school) and *places* (e.g., school, community centre, the tutee's home) (Gaustad, 1992; Gordon et al., 2007; Topping & Hill, 1995).

Although the specific *goals* and targeted *outcomes* vary, the underlying purpose of student tutoring programmes for the tutees are typically one of the following: (1) preventing academic problems; (2) providing remediation for those having difficulty, (3) maintaining students' current academic status, or (4) enhancing students' academic abilities (Ellison & Kritsonis, 2006; Gordon et al., 2007; Topping & Hill, 1995). For tutors, social/affective or transferable skills (e.g., communication skills, practice in applying knowledge and pedagogical techniques, understanding and responding to diversity among students) rather than cognitive goals are suggested to be the gains.

Finally, tutoring programmes address different *curricula*. Traditionally, there has been a dominant focus on subject-specific matter, like reading, mathematics, and science (Gordon et al., 2007; Ritter et al., 2009). It is especially regarding this dimension that the current dissertation is innovative with respect to prior research, as our goal is to investigate the effects of student tutoring on cross-curricular skills, namely self-regulated learning.

TutorBabbel as the specific student tutoring and research setting

In this dissertation, we evaluate the impact of the student tutoring programme called 'TutorBabbel'. In this programme, first year master students in Educational Sciences at Ghent University tutor fifth and sixth graders in primary school with a low socio-economic and/or immigrant background. For the tutors, the tutoring assignment is a formal part of the 7-credit course 'Coaching and Guidance'. Tutoring sessions occur during school hours in small groups of two or three tutees per tutor. The student tutoring programme takes place during 3 successive months during the first trimester of the school year: 10 student tutoring sessions of 100 minutes each are organised once a week (see Figure 1). For the tutees, the aim of the programme is to empower them by cultivating positive self-motivational beliefs, expanding their repertoire of learning strategies, and helping them to apply these to school-related tasks in a self-regulated manner. As such, the focus of the tutoring programme is on cross-curricular skills, namely SRL. For the tutors, this tutor assignment provides them with the opportunity to practice key tutoring processes (e.g., effective questioning, providing feedback) and to improve their understanding and sensitivity towards linguistically, ethnically, and culturally diverse students.

Figure 1. Tutors and tutees during TutorBabbel sessions.

In line with the finding that well-structured tutoring programmes are more effective (Cohen et al., 1982; Gordon et al., 2007; Ritter et al., 2009), and in order to support the tutors in providing instruction in SRL, a tutoring curriculum script was designed. The curriculum script consists of learning material for the tutees and a manual for the tutors detailing the learning goals and providing the tutors with scenarios to address the selected SRL components. The goal of the curriculum script is to structure the content and goals of the student tutoring sessions, while simultaneously allowing deviations from the script in order to tailor the sessions to tutees' needs. Further, to ensure the quality of tutoring and taking into account that tutoring programmes in which tutors receive prior training yield better outcomes (Cohen et al., 1982; Goodland, 1995; Gordon et al., 2007), tutors receive prior training and ongoing support. The training's content is twofold. On the one hand the tutors were trained in generic tutoring skills (e.g., effective questioning, prompting, scaffolding, providing feedback, and establishing a supportive relation) (Gordon et al., 2007; Graesser, Person, & Magliano, 1995; King, 1997). On the other hand, the training addressed how to promote SRL (e.g., offering choices, opportunities for students to evaluate themselves and others, creating intrinsically motivating learning contexts, fading support). To provide ongoing support for the tutors, two interim small-group supervision sessions with the university instructors, three group meetings with the tutees' teacher, and individual feedback sessions with the university instructors were organised.

Tutoring effectiveness

Gains for tutees

Despite the increased interest in and support for student tutoring programs in past decades, this has yet to be matched with a supporting research base. The lack of evidence for student tutoring is partially due to the fact that most tutoring research has focused on peer tutoring, or that evaluation of programs remains restricted to unpublished evaluation reports by the programme organisers (Ritter et al., 2009). Given the limited research specifically focusing on student tutoring, we also draw on research regarding human tutoring and volunteer tutoring to describe the effectiveness and tutoring processes, as these formats of tutoring often engage university or college students as tutor.

Although outcomes vary according to the particular design of the student tutoring programme, research generally shows positive outcomes for tutees (e.g. Cohen, Kulik, & Kulik, 1982; Gordon et al., 2007; Ritter et al., 2009; Topping & Hill, 1995). Based on a review of evaluation research, Topping and Hill (1995) report improved motivation, affective and attitudinal gains, lower drop-out, increased aspirations, and positive effects on academic achievement regarding reading and/or mathematics. However, they also report on programmes failing to establish significant academic gains. Based on a meta-analysis on the effectiveness of one-to-one tutoring programs for improving reading ability in primary students at risk for reading failure, Elbaum, Vaughn, Hughes, and Moody (2000) concluded that college students are able to provide significant help to struggling readers. More recently, Ritter et al. (2009) conducted a meta-analysis on the effectiveness of volunteer tutoring programmes. They reported a statistically significant positive effect size of 0.30 standard deviations on all reading outcomes. However, the evidence basis for tutoring programmes aimed at improving students' skills in other domains, such as writing or mathematics, was more limited and less convincing regarding its positive effects (Ritter et al., 2009).

Gains for tutors

As the focus in student tutoring programmes is mostly on tutees' progress in academic skills, effects for tutors are lesser topic of investigation. Benefits for tutors are mostly documented within the social/affective domain. Research demonstrates that tutors grow in social awareness and social responsibility, as well as in sensitivity and understanding of children with a social or ethnic background different from their own. Other important benefits are improved self-esteem, communication, and interpersonal skills (Dickinson, 1999; Topping & Hill, 1995). Moreover, tutoring leads to reflection on the meaning of education and the dynamics of personal growth (Topping & Hill, 1995). Cognitive gains for student tutors in curriculum areas are less frequently reported (e.g. Cohen et al., 1982).

Prerequisites for tutoring effectiveness

Although there is evidence that tutoring is effective in promoting learning in a variety of settings, such outcomes are not automatically guaranteed. Consequently, the question arises why is tutoring effective in promoting learning and which factors influence its effectiveness? In contrast to the investigation of tutoring's effectiveness, this question has only been addressed in recent years (Graesser, D'Mello, & Person, 2009). One approach to answering this question is to review prior studies or to conduct meta-analyses that relate learning gains with characteristics of the subject matter, tutee, tutor, and general structure of the tutoring sessions. In this respect, there is evidence, that (a) learning gains tend to be higher for lower-level skills as compared to higher-level skills; (b) learning gains for tutees who start with a comparatively lower amount of knowledge and skills are more pronounced, (c) tutoring sessions show more benefits when particular pedagogical activities (e.g., Socratic tutoring strategies, modelling–scaffolding–fading) are included, (d) training and support of tutors can facilitate the tutoring quality – in this respect, the quality of the tutor training is more important than the quantity, (e) well-structured tutoring programmes are more effective (Cohen et al., 1982; Gordon et al., 2007; Graesser et al., 2011; Ritter et al., 2009; Rohrbeck et al., 2003; Topping & Hill, 1995).

A second approach is to manipulate certain features of the programme design or tutoring activities and to observe the impact of these manipulations on learning gains (Chi, Roy, & Hausmann, 2008; Chi, Siler, Jeong, Yamauchi, & Hausmann, 2001; VanLehn et al., 2007; VanLehn, Siler, Murray, Yamauchi, & Baggett, 2003). For example, in a study of Chi et al. (2001) tutors were suppressed from giving explanations and feedback and were encouraged to prompt the students. Results showed that students learned just as effectively even when tutors were suppressed from giving explanations and feedback.

A third approach is to perform a detailed analysis of tutoring actions and processes. These process-based approaches can complement outcome-based approaches in important ways (Graesser et al., 2009). For example, process data enables detailed manipulation checks, allowing researchers to determine whether tutors followed instructions or whether they modified the training in unproductive or innovative ways. Process data on tutor and tutee behaviour cannot only lead to insights into the positive learning effects of tutoring, these data can also help researchers to diagnose and respond to the problems that hamper learning when studies do not show significant learning gains (Roscoe & Chi, 2007). Despite the high potential and added value of process data, the interest in collecting and analysing process data has grown only recently (Lepper & Woolverton, 2002; Roscoe & Chi, 2007; VanLehn et al., 2003). In this dissertation, we want to build further on this trend by documenting the strategies and actions adopted by tutors and tutees during tutoring focusing on SRL.

Tutoring processes

During tutoring a variety of instructional practices and techniques are observed, such as direct instruction, explaining, tutor modelling of thinking and problem-solving behaviour, scaffolding of support as students practice skills and strategies, and provision of immediate, positive, and corrective feedback (Chi et al., 2001; Graesser et al., 2011; VanLehn, 2011).

In general, tutorial interactions can be typified and contrasted as tutor-centred, student-centred and interaction-centred. These variables can be placed on a continuum (Graesser & McNamara, 2010). At the one end of the continuum is a typical *tutor-centred* session in which the tutor mainly lectures the tutee and takes a more didactic approach. The tutee is assigned a rather passive role and has little opportunities to take initiative or to articulate misunderstanding or comprehension (Graesser et al., 1995). In this extreme case of the lecturing tutor, tutoring will not be superior to normal classroom instruction with teacher monologues (Chi et al., 2001; Graesser & McNamara, 2010).

A *student-centred tutoring* session is placed at the other end of the continuum. In contrast to a tutor-centred session, in a student-centred session the tutee holds the control and sets the agenda for the sessions instead of the tutor. The tutee will actively engage in problem solving activities through self-explanations and regulating his learning, while the input of the tutor will be reduced to a minimum. The withdrawn of tutor responsibilities and guidance can be experienced as positive by the tutees under the condition they feel confident to take over the responsibility over their own learning process. However, this student-centred scenario is often limited by the fact that students are not very competent in calibrating their comprehension of material, in asking deep level questions, and purposefully setting their agendas in unguided circumstances (Chi et al., 2001; Graesser & McNamara, 2010; Graesser & Person, 1994; Graesser, Wiemer-Hastings, Wiemer-Hastings, & Kreuz, 1999).

Between both extremes, the *interaction-centred* session takes an intermediate position. In this case, the interactions between both parties is characterised by optimal scaffolding in which the tutee is actively engaged and the tutor subtly steers the interaction towards productive learning activities (Chi et al., 2008; Graesser & McNamara, 2010; Graesser et al., 1995). As such, tutors adopt a more Socratic instead of didactic approach. Moreover, it is argued that one-on-one instruction or small-group instruction, such as during student tutoring, creates a platform for more individualised and calibrated support compared to whole-class instruction (Butler, 2002; Wood & Tanner, 2012). Tutors can use different strategies to implement calibrated support (e.g., modelling, giving feedback, hinting, instructing, explaining, and questioning) (Chi et al., 2001; Graesser et al., 1995; Hadwin et al., 2005; Roscoe & Chi, 2007; van de Pol et al., 2010). Tutors are expected to ask a variety of question types allowing the tutees to reach deeper levels of understanding and reasoning, provide just-in-time instruction, provide immediate and constructive feedback while simultaneously avoiding direct corrective feedback, and be highly supportive and sensitive to tutees' motivational and emotional states (Chi, Siler, & Jeong, 2004; Gordon et al., 2007; Lepper & Woolverton, 2002; Merrill, Reiser, Merrill, & Landes, 1995; Topping & Ehly, 2001). This collaborative discourse should nurture tutees' constructive and interactive responses, leading to a joint construction of understanding and shared meaning (Chi et al., 2001). While further research is needed on this topic, it is believed that this interactive style of tutoring is more motivating and better placed to encourage transfer of students' knowledge instead of a didactic style of tutoring (Chi et al., 2001).

If tutoring is conducted in appropriate way it is presumably well suited to promote SRL, because the tutor can track knowledge and skills of individual students, tailor the tutoring session to tutees' personal needs and provide continuous and immediate feedback (Graesser & McNamara, 2010). Especially younger children and struggling learners seem to profit from more individualised instruction (Butler, 2002; Veenman et al., 2006; Zimmerman, 1990). Notwithstanding these promises, prior research has not explored whether tutoring processes during student tutoring focusing on SRL is indeed characterised by such sophisticated pedagogical techniques.

In conclusion, based on the literature review regarding student tutoring, several challenges can be seen. First, scientific research on student tutoring is rather limited, rather out-dated, and often based on small samples. In this respect, it is also observed that the evaluation of student tutoring programmes is sometimes based on scientifically sound experimental designs, while at other times it is based on subjective impressions and informal observations limiting the scientific value (Cohen et al., 1982; Topping & Hill, 1995; Wasik, 1998). Moreover, the effect sizes of the impact of student tutoring vary considerably across studies (Gordon et al., 2007; Ritter et al., 2009), underlining the need for further research regarding the effectiveness of student tutoring and tutoring processes occurring during student tutoring sessions. Second, given the dominant focus of student tutoring on subject-specific content at present, no information is available on the effectiveness of student tutoring to improve cross-curricular skills, such as self-regulated learning. However, given the similarities between key instructional tools for promoting SRL on the one hand and the characteristics of student tutoring (such as individualised help, more social involvement between tutor and tutee, modelling and scaffolding by the tutor, provision of immediate and relevant feedback, and more active and interactive learning) on the other, student tutoring might be considered as a suitable learning environment to promote SRL.

Research goals

Taken into account the research challenges in the literature, as already identified throughout this chapter, two main research goals are put forward, namely assessing SRL in late primary education and exploring the impact of student tutoring as a method to stimulate SRL.

Assessing SRL in late primary education

This dissertation builds upon the importance of stimulating SRL in primary education, and more specifically in 5th and 6th grade, especially among students who encounter difficulties. However, in order to stimulate SRL, it is important to gain insight in students' primary education. Given the dominant focus on secondary and higher education, information is rather limited for primary school children. This is especially the case for students with specific characteristics, like students from low socio-economic and immigrant background (Zeidner et al., 2000). This empirical shortage is also connected to the current need for valid measures of children's SRL (Winne & Perry, 2000). Consequently, a first challenge in conducting research on late primary school children's SRL is the measurement of SRL.

Therefore, a first aim in this dissertation was the *development of instruments* to measure primary school children's SRL. In the last decade the development and validation of measures and method to assess SRL has become a challenging research line within the research field. In the literature, several methods have been used to measure SRL, which can be categorised into on-line and off-line methods. Off-line methods (e.g., self-report questionnaires), are presented either before or after task execution, whereas on-line assessments (e.g., think-aloud protocols, observations) are obtained during task performance (van Hout-Wolters, 2009; Veenman, 2005). On-line methods are especially valued as these methods give information about the learning activities at the moment they take place (Veenman, 2011a). From a practical point of view, on-line methods are, however, very time and labour-intensive methodologies, making them less suitable for use in larger samples. In comparison, off-line methods, such as self-report questionnaires, are relatively easy to administer and to score (Cromley & Azevedo, 2011; van Hout-Wolters, 2009; Winne & Perry, 2000). However, as self-report instruments ask respondents to report on the extent to which they apply particular strategies, students have to retrieve earlier processes and performance from their (long term) memory. This reconstruction process might suffer from memory failure and distortions (Boekaerts & Corno, 2005; McNamara, 2011; Nisbett & Wilson, 1977; Schellings, 2011; Wirth & Leutner, 2008).

Nevertheless, researchers have also been acknowledging the value of self-report data, as it provides insights into self-perceived propensities of using a particular tactic or strategy when learning (McCardle & Hadwin, 2015; Perry & Winne, 2006; Pintrich, 2004; Richardson, 2004; Zimmerman, 2008). As each measurement has its advantages and disadvantages, researchers advise combining multiple means of operationalising and measuring SRL (Boekaerts & Corno, 2005; van Hout-Wolters, 2009; Veenman, 2005; Zimmerman, 2008) to triangulate data sources.

Building on the importance and value of multi-method design, a self-report questionnaire and think-aloud protocol were developed and validated in the present dissertation. Interestingly, few empirical studies have examined and described students' SRL as they approach the transition towards secondary education. Therefore, based on the developed instruments it was also aimed to conduct a *baseline assessment* of primary school children's natural and un-intervened SRL.

Exploring the impact of student tutoring as a method to stimulate SRL

As research underlines the importance of effectively promoting SRL in primary education and indicates that SRL becomes increasingly important during transition periods, this dissertation specifically focuses on fifth and sixth graders. We opted for student tutoring as an approach to foster SRL for several reasons. First, the characteristics of student tutoring, and especially the individualised help, are in line with the main recommendations regarding the promotion of SRL. Second, within the research field of SRL, promoting SRL by means of student tutoring has not been studied before. Additionally, within the research field of tutoring, studies into the effects of student tutoring programmes on SRL instead of on specific subjects are lacking. As such, we wanted to *investigate student tutoring as an innovative approach* to stimulate late primary school children's SRL. In this dissertation, we specifically focus on students from low socio-economic and/or immigrant background as providing additional instruction and support regarding SRL may be a valuable strategy to empower them.

Further, given the original one-sided focus on effect studies, empirical studies regarding process data are limited although such data can provide valuable insights into factors influencing the effectiveness of tutoring. By investigating tutoring processes which specifically focus on enhancing SRL within a student tutoring setting, we wanted to extend prior research focusing on tutoring processes.

In sum, clustered in both main research goals, the following subgoals can be distinguished in this dissertation:

Research goal 1: development of a self-report questionnaire to assess children's perceived use of self-regulatory learning strategies and development of a think-aloud protocol to assess children's use of self-regulatory learning strategies concurrent to task execution

Research goal 2: gaining insight into at-risk late primary school children's SRL by conducting baseline assessment of late primary school children's SRL

Research goal 3: studying the effectiveness of student tutoring on at-risk late primary school children's SRL

Research goal 4: investigating the tutoring processes during student tutoring focusing on SRL

Overview of studies in the dissertation

This dissertation entails 7 chapters including five chapters reporting on empirical studies, preceded by an introductory chapter (chapter 1) and followed by a concluding chapter (chapter 7). Chapter 3, 4, 5 and 6 document the different empirical studies and are based on published or submitted articles in journals listed in the Social Science Citation Index. Table 2 provides an overview of the research lines, chapters, research goals, research design and sample, data collection and triangulation, and data-analysis techniques for the different studies. The structure of this dissertation, the relation of the studies to the four research goals, and the interrelation between the studies is presented in Figure 2, which will be elaborated on in subsequent paragraphs.

Chapter 1 is an introductory chapter wherein the theoretical framework of the two key concepts of this dissertation, namely SRL and student tutoring, are outlined. Throughout the framework different research challenges in the research field of SRL and student tutoring are described, leading to the research goals of the present dissertation. This chapter concludes with an overview of the design and the studies included in the dissertation.

As a starting point, a pilot study was conducted to explore the effects of a student tutoring programme focusing on SRL. This study is documented in Chapter 2, *Exploring the impact of student tutoring on at-risk fifth and sixth graders' self-regulated learning.* In this study, a pre-post test design was used involving 93 Flemish fifth- and sixth-grade tutees at-risk due to their socio-economic and/or immigrant background. In absence of comprehensive measurement instruments to assess simultaneously the three key components of SRL, three different instruments were used to investigate the effects of the student tutoring programme on students' SRL. More concretely, the 'Learning Motivation Test' (Miedema & de Vos, 2004), 'Junior Metacognitive Awareness Inventory' (Sperling, Howard, Miller, & Murphy, 2002), and 'Self-Regulated Learning Interview Schedule' (Zimmerman & Pons, 1986) were administered. A well-structured student tutoring programme was implemented in which university students tutored fifth and sixth graders in small groups, spread over a period of three successive months. Besides reporting on the effects of student tutoring on at-risk children's SRL (i.e., research goal 3), the study also provides descriptive data regarding SRL among fifth and sixth graders from low socio-economic and/or immigrant background (i.e., research goal 2). This pilot study was an important point of departure for the setting up of the further studies in this dissertation. First, this study confirmed that students from a low socio-economic and/or immigrant background encountered difficulties in regulating their learning, but that training can improve these competencies. Second, while demonstrating that student tutoring can be beneficial to support SRL, the mixed results for fifth and sixth graders also underlined the need for further research. Finally, this study illustrated the value of combining different measurement methods and perspectives to assess SRL, but concurrently confirmed the need for more comprehensive measurement methods, both off-line and on-line, to assess the three main components of SRL simultaneously and to investigate the effects of SRL interventions. Furthermore, the developed student tutoring programme can be used as a baseline in further large-scale research. This chapter is published in *Learning and Individual differences*.

Chapter 3 and 4 focus on the first and second research goal. Chapter 3, *Measuring the complexity of late primary school children's self-regulated learning: A multi-component approach*, reports on the development and validation of the Children's Perceived use of Self-Regulated Learning Inventory (CP-SRLI) consisting of nine components. Building on the adjusted framework of Pintrich (2000), a multistep process was used to develop the questionnaire, including reviews by a teacher and expert panel and cognitive interviews with late primary school children. The original 109-item questionnaire was then presented to 967 fifth and sixth graders (sample 1). Subsequent to parallel analysis and exploratory factor analyses on each component, the factor structure of each component was investigated by confirmatory factor analyses using an independent second sample (723 fifth and sixth graders). Further, measurement invariance across gender and gender differences were examined. Based on these data also baseline assessment (i.e., research goal 2) of late primary school children's SRL was provided. This chapter is published in *Contemporary Educational Psychology*.

The aim of Chapter 4, *Using think-aloud protocol analysis to gain in-depth insights into late primary school children's self-regulated learning*, was to gather in-depth and longitudinal information regarding late primary school children's SRL, specifically focusing on students at-risk for school failure. Through a longitudinal study eight at-risk students were followed during two successive school years by using think-aloud protocols. During the think-aloud sessions, students were asked to solve a Sudoku and to study an informative text and concurrently verbalise all their ongoing actions and thoughts. In total, 1 097 minutes of audio- and videotape were collected across six measurement occasions. Descriptive analyses were conducted to provide insight into students' self-regulatory strategy use and non-parametric Friedman ANOVA's were conducted to explore change over time. The manuscript of this chapter has been submitted to *Learning and Individual Differences.*

The developed self-report questionnaire and think-aloud protocol, were applied in a large-scale intervention study described in chapter 5, *Stimulating self-regulated learning among primary school children with a low socio-economic and immigrant background by means of student tutoring*. While this study also provides insight into students' SRL (i.e., research goal 2), the main aim of this study was to investigate the effectiveness of student tutoring on fifth and sixth graders' SRL (i.e., research goal 3). Moreover, we studied whether students with different motivational profiles benefit differently from the student tutoring intervention. In order to achieve this objective, a quasi-experimental study with pretest, posttest, and retention test control group design was used, combining teacher ratings, a student self-report questionnaire (CP-SRLI), and think-aloud protocols. In total, 219 fifth and 185 sixth-grade students at-risk due to their socio-economic and/or immigrant background participated in the study. In the experimental condition, 106 pupils (tutees) received guidance of university student tutors during 10 successive weeks. After performing cluster analysis to determine the motivational profiles, mixed ANOVA was performed on the different data sources to determine the effect of student tutoring on students' SRL. This chapter is accepted for publication in the *Journal of Educational Research.*

Chapter 6, *Studying tutoring processes during student tutoring focusing on self-regulated learning by means of video analysis*, goes more deeply into the tutoring process occurring during student tutoring focusing on SRL (i.e., research goal 4). During the 10 week student tutoring programme, three tutoring groups were studied in depth. Of each group four tutoring sessions were video-taped resulting in 1,071 minutes of video data. Based on multiple stages of coding, tutor and tutee interactions were studied as well as the shift in self-regulatory ownership across different tutoring sessions. Besides providing descriptive analyses, chi-square analyses and multinomial regression analyses were conducted. The manuscript of this chapter has been submitted to *Cognition and Instruction.*

Chapter 7 summarizes the results of the previous chapters and provides a general conclusion and discussion related to the research goals. In addition, limitations and suggestions for further research are discussed. The chapter concludes with a discussion of contributions and implications for theory, research, practice, and policy.

Table 2

Research goals, chapters, research design and sample, data-collection and triangulation, and data-analysis techniques

Chapter	Research goal	Specific research objectives	Research design and sample	Data collection	Data-analysis techniques
1		General introduction (theoretical framework, research goals, research design, and overview of the dissertation)			
2	2 + 3	To explore the impact of the student tutoring programme on the (1) learning motivation, (2) metacognitive awareness, and (3) SRL strategy use of fifth and sixth graders with a low socio-economic and/or immigrant background (pilot study).	Pretest-posttest design (n=93)	Self-report questionnaire Structured interview	Paired-sample t-test (SPSS)
3	1 + 2	To develop and validate a comprehensive and coherent set of scales to assess students' SRL. To investigate measurement invariance across gender. To investigate gender differences in SRL. To assess children's perceived use of SRL.	Cross-sectional survey ($n_{\text{sample 1}}$= 967, $n_{\text{sample 2}}$=723)	Self-report questionnaire	EFA (SPSS, R, Lavaan packages) CFA (R, Lavaan packages)
4	1 + 2	To develop think-aloud protocol to assess students' SRL. To investigate the evolution of SRL in students with a low socio-economic and/or immigrant background by means of think-aloud protocols.	Longitudinal study design (n=8)	Think-aloud methodology	Within-case and cross-case analysis Non-parametric Friedman's ANOVA
5	2 + 3	To describe the initial state of SRL among students with a low socio-economic and/or immigrant background. To investigate the effects of student tutoring on SRL among students with a low socio-economic and/or immigrant background. To explore the differential effects of student tutoring for students' with different motivational profiles.	Quasi-experimental repeated measures design (n_{exp}=106; n_{con}=295)	Self-report method Think-aloud methodology Teacher ratings	Cluster analysis (SPSS) Mixed ANOVA (SPSS)
6	4	To identify the occurrence of different tutor and tutee actions during student tutoring. To study sequences of occurrence in tutor and tutee actions. To study the evolution of self-regulatory ownership across tutoring sessions	Repeated measure design (n=3)	Interaction analysis	Chi-square analysis (SPSS) Multinomial regression analyses (R packages)
7		General conclusion and discussion (overview and discussion of the main results, limitations and suggestions for future research, implications of the dissertation)			

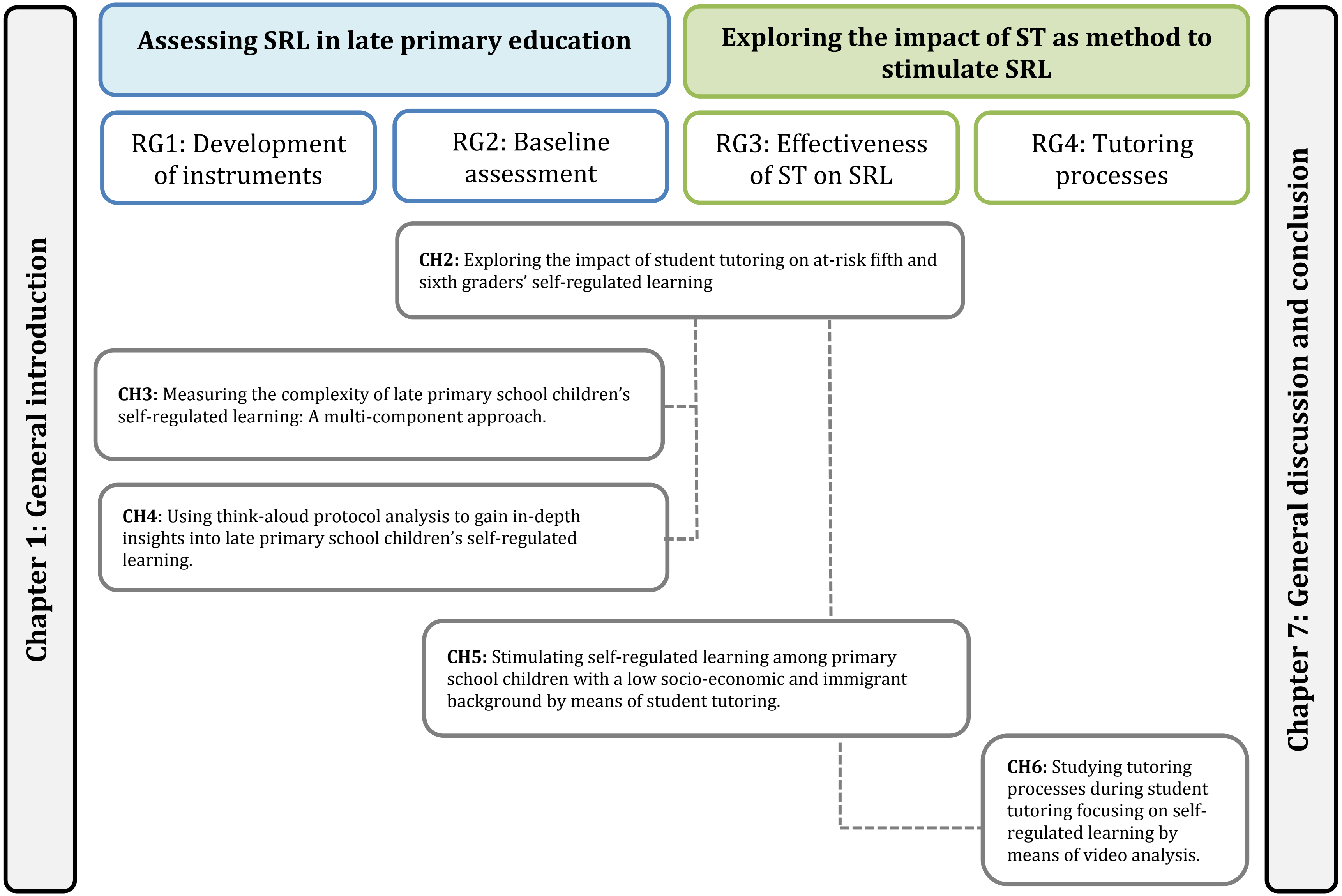

Figure 2. Overview of the studies and their relation to the research goals and dissertation chapters.
Note. RG = research goal, CH = chapter, ST = student tutoring

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2

Exploring the impact of student tutoring on at-risk fifth and sixth graders' self-regulated learning

This chapter is based on:

Vandevelde, S., Van Keer, H., & De Wever, B. (2011). Exploring the impact of student tutoring on at-risk fifth and sixth graders' self-regulated learning. *Learning and Individual Differences, 21*(4), 419-425. doi: 10.1016/j.lindif.2011.01.006

Chapter 2
Exploring the impact of student tutoring on at-risk fifth and sixth graders' self-regulated learning

Abstract

This study explores the effects of a student tutoring programme focusing on self-regulated learning. Ninety-three Flemish fifth- and sixth-grade tutees at-risk due to their socio-economic and/or immigrant background participated. A pre-post test design was used and the 'Learning Motivation Test', 'Junior Metacognitive Awareness Inventory', and 'Self-Regulated Learning Interview Schedule'(SRLIS) were administered. In line with prior research, the present study demonstrates beneficial effects of student tutoring. More specifically, positive effects on sixth graders' learning motivation and metacognitive awareness are revealed. In contrast, no effects on learning motivation and metacognitive awareness were found for fifth graders. Based on the qualitative analysis of SRLIS, both fifth and sixth graders displayed the use of a larger variety of self-regulated learning strategies after the intervention. Suggestions for further research are discussed in order to corroborate and broaden the findings of the present study.

Introduction

As research reveals that students from lower socio-economic and/or immigrant background tend to perform less well at school than their peers (OECD, 2004, 2006), providing an equitable distribution of educational opportunities has become an important challenge for educational systems. Therefore, it is imperative to study initiatives that can enhance the educational opportunities of these target groups. Recently, tutoring has been considered as a promising method to provide individual support to students who are at-risk for educational failure (Barley et al., 2002; Cassio, 2008; Ritter, Barnett, Denny, & Albin, 2009). In this respect, the present study centres on the implementation and evaluation of a student tutoring project focusing on self-regulated learning.

Student tutoring

Student tutoring refers to "the practice of having students from universities and colleges tutor pupils in primary and high school classrooms under the guidance of the class teacher" (Topping & Hill, 1995,p. 15). Research generally shows positive outcomes for tutees on the cognitive, affective, and social level (e.g., Cohen, Kulik, & Kulik, 1982; Gordon, Morgan, O'Malley, & Ponticell, 2007; Ritter et al., 2009; Topping & Hill, 1995). Positive outcomes for tutees include increased aspirations, improved basic skills, deeper learning, improved motivation, affective and attitudinal gains, intrinsic interest in the subject matter, and a reduction in drop-out (e.g., Cohen et al., 1982; Gordon et al., 2007; Ritter et al., 2009; Topping & Hill, 1995) Moreover, DuBois, Holloway, Valentine, and Cooper (2002) argue that students at-risk are more likely to benefit from participation in tutoring programmes.

These positive effects can be explained by the typical characteristics of student tutoring, namely individualised help, greater social involvement between tutor and tutee, modelling and scaffolding by the tutor, provision of immediate and relevant feedback, and more active and interactive learning (e.g., Chi, Siler, Jeong, Yamauchi, & Hausmann, 2001; Gordon et al., 2007; Topping, 2000).

Self-regulated learning

Most previous studies on tutoring (e.g., Barley et al., 2002; Cohen et al., 1982; Gordon et al., 2007; Topping, 1996) has focused on a specific subject as curriculum of tutoring (e.g., mathematics, science, reading). In contrast, the present study focuses on cross-curricular skills, namely self-regulated learning (SRL).

Although definitions of SRL differ depending on researchers' orientations, there is agreement on Zimmerman's (1990) general conceptualisation that self-regulated learners are metacognitively, motivationally, and strategically active participants in their own learning (e.g., Boekaerts, 1999; Paris & Paris, 2001; Perry, Phillips, & Dowler, 2004; Winne & Perry, 2000). The metacognitive component refers to planning, setting goals, organising, self-monitoring, and self-evaluating during the learning process (e.g., Boekaerts, 1999; Pintrich, 2004). In terms of motivational processes, high self-efficacy, self-attributions, and intrinsic task interest are emphasised (e.g., Pintrich, 2004; Zimmerman, 2000). The strategic or cognitive component refers to students' learning strategies and tactics (Azevedo & Cromley, 2004; Boekaerts, 1999; Hadwin, Wozney, & Pontin, 2005; Winne, 2001) and to how they select, structure, and create environments optimising learning (Perry et al., 2004; Zimmerman & Martinez-Pons, 1990).

Research reveals that primary school children are capable of acquiring self-regulatory skills (Perry, 1998; Veenman, van Hout-Wolters, & Afflerbach, 2006; Whitebread et al., 2009). Notwithstanding these findings and the call for promoting SRL early in students' school careers (Perry et al., 2004; Veenman & Spaans, 2005), only little research has been conducted on young children's SRL (Winne & Perry, 2000). Additionally, SRL becomes increasingly important in transition periods in which students switch from a more closely monitored environment, like primary education, to an environment in which greater independence is expected, like in secondary education (Cleary & Zimmerman, 2004; Dembo & Eaton, 2000). To successfully make this transition, students need a repertoire of learning strategies and self-regulatory strategies. Therefore, the present study focuses on fifth and sixth graders.

We opted for SRL as the focus for student tutoring for several reasons. First, SRL is considered as an important educational goal (Boekaerts, 1999; Claxton, 2007; Paris & Newman, 1990), since self-regulation processes lead to success in and beyond school (Schunk, 2005; Zimmerman, 2002). Second, although research shows that self-regulatory process are teachable (Paris & Paris, 2001; Perels, Dignath, & Schmitz, 2009), few teachers effectively prepare students to learn independently and generally stimulate SRL only to a limited extent (Lombaerts, Engels, & Vanderfaeillie, 2007; Perry et al., 2004; Weinstein, Husman, & Dierking, 2000; Wingate, 2007; Zimmerman, 2002). Third, research indicates that a large number of learners shows difficulties regulating their learning process efficiently and effectively (Perry et al., 2004; Pintrich, 2004; Schunk & Ertmer, 2000; Winne, 2005; Zimmerman, 2002). Moreover, at-risk students have less experience and prior knowledge about effective strategies (Dembo & Eaton, 2000; Larkin, 2009), and require more instruction and practice regarding SRL (Dembo & Eaton, 2000; Veenman & Verheij, 2003; Weinstein et al., 2000). In this respect, the present study especially focuses on at-risk students. Finally, research indicates that students have the potential to become self-regulated learners, but personalised attention and close guidance is needed to enhance this development (Fazey & Fazey, 2001; Winne, 2005). Especially young children profit from a close and individualised guidance to refine their self-regulatory processes (Schunk & Ertmer, 2000; Zimmerman & Martinez-Pons, 1990). In this perspective, student tutoring, characterised by individual support and adaptive scaffolding, can be a valuable method to facilitate the development of SRL among late primary school children.

Aim of the present study

The main aim of the study is to explore educational benefits of a student tutoring programme aiming at empowering at-risk fifth and sixth graders by cultivating positive self-motivational beliefs, expanding their repertoire of learning strategies, and helping them to apply these to school-related tasks in a self-regulated manner. Specifically, we focus on three research questions: What is the impact of the student tutoring programme on the (1) learning motivation, (2) metacognitive awareness, and (3) SRL strategy use of at-risk fifth and sixth graders?

Method

Participants

Forty-five fifth and 48 sixth graders from six classes from four Flemish inner-city schools participated as tutees (42 boys, 51 girls, mean age=11.06, *SD*=0.79). Based on criteria of the Flemish Department of Education 72% of the tutees were at-risk students due to their low socio-economic and/or immigrant background. Forty-three first master students Educational Sciences (9 males, 34 females) were engaged as tutors.

Design

A pretest-posttest design was used. The intervention took place during 3 successive months: 9 student tutoring sessions of 100 minutes each were organised once a week.

Intervention

The intervention was characterised by student tutoring focusing on SRL. Tutoring occurred in small groups of two to three tutees per tutor and took place during school hours.

The intervention was developed taking into account theoretical and empirical preconditions promoting SRL and effective tutoring (see also chapter 5 for a more comprehensive description of the intervention). First, following the social cognitive perspective, modelling, prompting, and scaffolding are viewed as key instructional tools for promoting SRL (Schunk, 2001; Zimmerman, 2002). This social cognitive model suggest that the development of self-regulatory competence begins with extensive social guidance, which is systematically reduced as learners acquire self-regulatory skills (Schunk, 2001; Winne, 2005; Zimmerman, 2002). As a consequence, there should be a shift from models providing direct instruction and modelling regulation towards students taking control and demonstrating self-regulatory competence (Hadwin et al., 2005). In order to evolve from external regulation over co-regulation to self-regulation, scaffolding is a critical issue whereby models provide calibrated support based on an ongoing diagnosis of students' level of understanding (Puntambekar & Hübscher, 2005). These insights were incorporated into the intervention by: (a) tutors functioning as models providing direct instruction and scaffolding and fading their support throughout the intervention; (b) tutoring in small groups guaranteeing close guidance and feedback; and (c) alternation between direct instruction and hands-on practice with authentic learning materials.

Further, the following characteristics of effective student tutoring and SRL interventions were incorporated: (a) using a tutoring curriculum script structuring the content of the sessions and ensuring deliberate practice and structure (Gordon et al., 2007; Ritter et al., 2009); (b) addressing all three SRL components instead of training selected components (see Appendix for an overview of the sessions) (Dignath & Büttner, 2008; Perels, Gürtler, & Schmitz, 2005; Schunk & Ertmer, 2000); and (c) providing a tutor training, addressing both generic tutoring skills and activities promoting SRL (Goodland, 1995; Gordon et al., 2007), and ongoing support for tutors (Gordon et al., 2007). To ensure treatment validity, observations of the student tutoring activities were conducted on regular basis by the researchers.

Instruments

Self-report questionnaire

Tutees completed two self-report questionnaires. The subscale 'learning motivation' (21 multiple choice items) from the 'Learning Motivation Test' (LMT) (Miedema & de Vos, 2004) was used (example item: I like doing my homework). A sum score varying between 0 and 21 was calculated. Cronbach's α was .75 (pretest) and .77 (posttest). Further, the 'Junior Metacognitive Awareness Inventory' (Jr. MAI) version B (Sperling, Howard, Miller, & Murphy, 2002) was used (example item: I decide what I need to get done before I start a task). Responses were made on a five-point Likert-scale, ranging from never (1) to always (5). Following Sperling et al. (2002) the items were approached as one scale. After discarding three of the 18 items, the scale showed good internal consistency. Cronbach's α was.78 (pretest) and .82 (posttest).

Structured interview

Tutees were interviewed using the Self-Regulated Learning Interview Schedule (SRLIS) (Zimmerman & Pons, 1986), assessing 12 classes of SRL strategies (see Table 3). The SRLIS presents eight learning contexts (i.e., classroom learning, writing assignment, mathematics assignment, test preparation, dealing with poor learning motivation and distractions, arranging place of study, checking homework assignments, checking tests). For each learning situation, tutees indicate how they respond to the situation and score how frequently they use SRL strategies based on a four-point Likert-scale ranging from seldom (1) to most of the time (4). The SRLIS was approached both quantitatively and qualitatively. First, answers were coded corresponding to the 12 classes distinguished by Zimmerman and Martinez-Pons (1986). Two coders double-coded 25% of the interviews. Cohen's kappa (κ =.83) indicates high interrater reliability. Second, following Salisbury-Glennon, Gorrell, Sanders, Boyd, and Kamen (1999) 'strategy occurrence' (SO) was calculated in following manner. For each mentioned strategy, participants rated how frequently they used the particular strategy using the four-point Likert-scale. Through summing these frequency scores for each strategy, a measure of the use or importance of each strategy for each participant could be derived. For example, participant 1 reported the strategy of self-evaluation 3 times during the interview, and indicated a frequency score of 3, 2, 3 respectively for each time it was reported. Using the strategy occurrence method, participant 1 gets a score of 8 for the strategy of self-evaluation. Third, the specific answers were qualitatively administered and qualitatively compared before and after the intervention.

Results

Learning motivation and metacognitive awareness

Table 1 presents tutees' pre- and posttest learning motivation and metacognitive awareness. Learning motivation and metacognitive awareness appears to be high at both pre- and posttest. For sixth graders, a paired samples t-test indicates a significant increase in learning motivation (t = -2.37, df = 35, p = .024, d = 0.27) and metacognitive awareness (t =-2.85, df = 38, p =.007, d = 0.44) from pre- to posttest. No significant differences were found for fifth graders' learning motivation (t = 1.353, df = 18, p= .193) and metacognitive awareness (t = 1.319, df = 37, p = .195).

Table 1
Results of pre- and posttest of LMT and Jr. MAI

Measurement occasion	LMT		Jr. MAI	
	M	*SD*	*M*	*SD*
		Fifth grade		
Pretest	14.83	3.43	3.89	0.56
Posttest	14.45	3.58	3.75	0.48
		Sixth grade		
Pretest	13.77	3.29	3.64	0.38
Posttest	14.82	3.58	3.82	0.53

Self-regulated learning strategies

As presented in Table 2, fifth and sixth graders use a variety of strategies to self-regulate their learning and most frequently report strategies of 'self-evaluation', 'goal setting and planning', 'environmental structuring'. Based on the qualitative analysis of the pretest a more detailed description of the twelve SRL strategies arises (see Table 3). Statements regarding 'self-evaluation' mostly concern checking completed assignments, rather than checking tests. The majority of the students also report evaluation concerning content. Students mentioned that self-evaluation is more likely to occur when they have plenty of time and when they perceive the task/test as difficult. As to 'goal setting and planning' following aspects are quoted: scheduling homework (especially difficult and/or larger tasks), analysing task demands, and to a lesser extent activating prior knowledge about the characteristics of a good task. In this respect, students also report various personal step-by-step plans to study or complete assignments. Statements regarding 'environmental structuring' indicate that students select a place to make their homework depending on the level of difficulty and type of task, the level of distraction, and the availability of (non-)social resources. The majority of the students has a fixed place to study. In preparing for a test, students often refer to statements regarding 'rehearsing and memorizing': remaking exercises, reciting or copying lessons until known by heart, covering the right answers or parts of the study text. With regard to 'organising and transforming' students mainly report making a draft of difficult tasks and to a small extent rearranging instructional material in preparing for a test. With respect to 'keeping records and monitoring' statements are restricted to noting the main issues of a lesson and paying more attention during class. Monitoring one's own actions and behaviour while performing a task is reported only rarely. Furthermore, 'self-consequating' is rather often mentioned. In order to control one's own motivation, students most commonly indicate self-talk (verbal reinforcement or praise), arranging or imagining rewards or punishments for success or failure at a particular task or when they preserve a difficult task. As to the three categories regarding 'seeking social assistance' (strategy 9-11), it can be noticed that seeking assistance is less frequently reported. Based on the comments of the respondents, three main reasons for seeking social assistance can be distinguished: additional explanation or help when they encounter difficulties, checking homework, and questioning after studying. Parents, and especially mothers, are important social resources, followed by the class teacher and peers (classmates, brother, or sister). Finally, the strategies 'seeking information' and 'reviewing records' are reported rarely. The former refers to students searching further information from non-social sources when undertaking an assignment (e.g., library, Internet). As to the latter, students review their notes and textbooks in preparing for a test.

SRLIS pre- and posttest results are compared quantitatively and qualitatively. For fifth graders, paired-sample t-test shows a marginally significant increase in 'organising and transforming' (t = -1.995, df = 28, p = .056, d = 0.50). At pretest, students primarily refer to making a draft, whereas at posttest the majority of the reported strategies refer to distinguishing main issues from side issues by means of mind mapping or highlighting key words. For sixth graders, the results indicate a significant decrease in 'social assistance from teachers' (t = 3.333, df = 38, p = .002, d = 0.64) and 'adults' (t = 2.960, df = 38, p = .005, d = 0.46). For 'social assistance from peers', a marginally significant decrease is observed (t = 1.721, df = 38, p = .093, d = 0.22). Further, a marginally significant increase in 'seeking information' is found (t = -1.958, df = 38, p = .058, d = 0.42), particularly due to the higher occurrence of utterances concerning the use of a dictionary as additional resource.

Although the quantitative results show no significant differences regarding other strategies, qualitative analysis reveals that students approach certain classes of SRL considerably different from pretest to posttest. A first difference concerns 'self-evaluation'. Whereas at pretest the reported self-evaluation methods are rather superficial (e.g., "I quickly reread the whole assignment"), more profound methods are mentioned at posttest (e.g., "I check whether I made mistakes and remake difficult exercises"), occasionally referring to additional resources (e.g., using a calculator, a dictionary). Similarly, substantive differences are found in the personal step-by-step plans (cf. 'goal setting and planning'). At pretest, the reported plans are quite similar across respondents and rather basic (e.g., "If I have to write an essay, I reflect on the topic, make a draft version, check my draft, and make the final version"). After the intervention, however, these plans reflect more systematic and goal-oriented approaches integrating various strategies (e.g., "If I have to write an essay, I reflect on the topic by making a mind map about what I already know, search for additional information, note keywords, rearrange the keywords, write a draft version and check it to ensure that I address the most important issues before making a final version"). Moreover, the plans are more varied across respondents, pointing at more personalised methods. Posttest statements regarding 'environmental structuring' indicate more actively avoiding distraction and a higher awareness of personal preferences regarding study environment. Statements regarding 'rehearsing and memorising' show more variation in the applied learning strategies at posttest as well. At pretest, strategies are mainly restricted to rehearsing strategies (remaking exercises, covering the learning material, reciting, copying material). At posttest, students also report more deep-level strategies (generating and answering questions, summarising, and mnemonic techniques).

Table 2

Results of pre- and posttest of SRLIS

Strategy	Strategy occurrence			
	Fifth grade		Sixth grade	
	Pretest	Posttest	Pretest	Posttest
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*
1. Self-evaluation	14.45 (7.85)	12.51 (5.52)	18.67 (9.86)	17.12 (9.21)
2. Organising and transforming	5.39 (4.10)	7.74 (4.86)	8.95 (5.66)	9.39 (5.92)
3. Goal setting and planning	9.27 (6.04)	9.22 (5.00)	13.15 (6.50)	11.56 (7.32)
4. Seeking information	1.19 (2.12)	1.53 (2.23)	0.87 (1.70)	1.82 (2.59)
5. Keeping records and monitoring	5.47 (4.43)	5.23 (3.24)	6.79 (4.63)	5.80 (3.87)
6. Environmental structuring	7.31 (3.80)	7.65 (4.31)	10.47 (6.22)	9.06 (4.51)
7. Self-consequences	4.10 (2.88)	4.32 (3.97)	5.15 (3.38)	3.92 (2.78)
8. Rehearsing & memorising	6.37 (4.59)	4.99 (3.33)	7.28 (6.06)	7.18 (4.44)
9. Seeking social assistance from peers	1.58 (2.36)	2.10 (2.68)	2.54 (3.42)	1.86 (3.31)
10. Seeking social assistance from teachers	.82 (1.67)	1.08 (1.87)	3.34 (3.12)	1.65 (2.13)
11. Seeking social assistance from adults	4.20 (4.60)	5.05 (5.27)	5.49 (5.39)	2.98 (3.62)
12. Reviewing records	3.08 (2.77)	2.59 (1.77)	2.15 (2.19)	2.76 (2.37)
13. Other	1.71 (2.53)	1.21 (2.05)	1.85 (2.52)	1.35 (2.12)

Table 3

Definitions of SRL strategies and description of reported statements during SRLIS according to the 12 categories (pretest)

	Definition of SRL strategies according to Zimmerman and Martinez-Pons (1986)	Description and examples of reported statements
1.	Self-evaluation Student-initiated evaluations of the quality of completed work.	• Checking completed assignments *e.g., "After completing my task, I reread it."* • Depending on availability of time and task difficulty *e.g., "I only check my assignment if there is time left."*
2.	Organising and transforming Student-initiated overt or covert rearrangement of instructional material to improve learning.	• Making a draft of difficult tasks e.g., *"I make a draft version of my essay."* • Rearranging instructional material in preparing for a test e.g., *"In my text, I highlight key words."*
3.	Goal setting and planning Student setting of educational goals or subgoals and planning for sequencing, timing and completing activities related to those goals.	• Scheduling homework (especially difficult and/or larger tasks) e.g., "*When I have to study for a difficult test, I start studying a few days before the test."* • Analysing task demands e.g., *"I carefully read the instructions."* • Activating prior knowledge about characteristics of a good task e.g., *"Before I start making math exercises, I think about how I will make the exercise."* • Personal step-by-step plans to study or complete assignments e.g., *"If I have to study a text, I first read the whole text. Then I copy the text and reread the text. Finally, I try to recite the text and after a pause I rehearse."*
4.	Seeking information Student-initiated efforts to secure further task information from non-social sources when undertaking an assignment.	• Searching further information from non-social sources (library, Internet) *e.g., "If I have to write an essay, I search for additional information on the Internet."*
5.	Keeping records and monitoring Student-initiated efforts to record events or results.	• Noting main issues of a lesson e.g., "*I note the main issues of the lesson."* • Paying more attention during class e.g., *"During class, I listen attentively."* • Monitoring one own's action while performing task e.g., *"If it doesn't work out, I try another way."*
6.	Environmental structuring Student-initiated efforts to select or arrange the physical setting to make learning easier.	• Fixed place to study e.g., *"I always make my homework in my room."* • Arrange the study environment e.g., *"Before I make my homework, I tidy my desk and put my things ready."*

		• Selecting a place depending on (a) level of difficulty and type of task; (b) level of distraction; (c) availability of (non-) social resources e.g., *"If I have to prepare a difficult test, I study in my room. Otherwise, I make my homework in the kitchen."*
7.	Self-consequences Student arrangement or imagination of rewards or punishment for success or failure.	• Verbal reinforcements or praise e.g., *"If I have to finish a difficult task, I say to myself: 'You finished another exercise, good job, keep on working'."* • Arranging or imagining rewards or punishments for success or failure e.g., *"After finishing my homework, I can watch television."*
8.	Rehearsing and memorising Student-initiated efforts to memorise material by overt or covert practice.	• Remaking exercises e.g., *"If I have to prepare a math test, I remake an exercise."* • Reciting or copying lessons e.g., "*In preparing for a test, I keep reciting the sentences until I know it by heart."* • Covering right answers or parts of the study text e.g., *"In studying a text, I cover part of the text and try to recite it."*
9.-11.	Seeking social assistance from peers (9), teacher (10), and adults (11). Student-initiated efforts to solicit help from peer, teachers, and adults.	• 3 main raisons: (a) additional explanation or help when encountering difficulties; (b) checking homework; (c) questioning after study • Parents (mother) are important social resources, followed by teacher and peers e.g., *"If I have problems with my assignment, I ask my brother for help", "I ask my mother to check my homework".*
12.	Reviewing records Student-initiated effort to rereading records, like notes or textbooks.	• Reviewing notes and textbooks in preparing for a test e.g., *"When preparing for a test, I review my textbook."*

Discussion

This study examined the impact of a student tutoring programme on fifth and sixth graders' learning motivation, metacognitive awareness, and SRL strategy use.

Learning motivation and metacognitive awareness

The intervention had a positive effect on sixth graders' learning motivation and metacognitive awareness. This can be explained by the key features of student tutoring: individualised help, stimulating learning environments, modelling, and scaffolding (Chi et al., 2001; Gordon et al., 2007; Topping, 2000). These characteristics are in accordance with the key instructional tools emphasised by social cognitive and social-cultural perspectives on SRL (Hadwin et al., 2005; Zimmerman, 2000). The increase in learning motivation is of particular interest as motivation is an essential, but less investigated aspect of SRL (Boekaerts & Corno, 2005; Cooper & Corpus, 2009). Students do not only need to have the skill but also the will to self-regulate their learning (e.g., Weinstein et al., 2000). Further, this finding confirms that motivation can be fostered through deliberate interventions (Dignath & Büttner, 2008; Wolters, 2003). As motivation has a positive impact on learning and SRL (Schunk & Ertmer, 2000; Zimmerman, 2000), we advise future interventions at primary school level to take students' need for encouragement and motivational support into account when enhancing SRL, especially among at-risk children (Boekaerts, 2010).

The effect sizes can be described as small to medium (Cohen, 1988). The effect sizes are in line with, but on average slightly smaller than, previously reported effect sizes of student tutoring programmes (e.g., Barley et al., 2002; Gordon et al., 2007) and SRL interventions (e.g., Dignath & Büttner, 2008; Perels et al., 2005; Stoeger & Ziegler, 2008). It should be noticed, however, that the effect sizes are not completely comparable since previous studies mainly focus on specific subjects (e.g., reading, writing, and mathematics). As to the effectiveness of tutoring interventions, Gordon et al. (2007) point out in this respect that interventions addressing lower-level skills (e.g., computational skills in math) have been found to be more effective than interventions addressing the development of higher-level skills (e.g., reading comprehension). Therefore, further research should focus on identifying key components of effective student tutoring programmes promoting higher-level skills, like in this case SRL.

The intervention did not succeed in improving fifth graders' learning motivation and metacognitive awareness. This unexpected result might be explained by various assumptions. According Veenman and Spaans (2005), metacognitive knowledge gradually grows from the age of 4-6 years, but the development of metacogntive skills is not expected to set in before the age of 11-12 years. Therefore, it can be assumed that for (some) fifth graders the intervention occurred too early in their development of metacognitive skills and more generally SRL. These results confirm the need for further research investigating the development of young children's SRL and how these skills can be facilitated at differing ages (Pressley, Graham, & Harris, 2006;

Weinstein et al., 2000; Zeidner, Boekaerts, & Pintrich, 2000). Fifth-grade results can also be explained by students' rather high starting level, which might be related to the use of self-report questionnaires. Although the applied instruments were previously validated, they may not have been sensitive enough to measure changes in learning motivation and metacognitive awareness accurately across a relatively short period of time. Moreover, self-report questionnaires depend on students' self-awareness of their approach to study (Boekaerts & Corno, 2005). Consequently, validity remains an issue, for student recall can be inaccurate and systematic error may result when students consistently under- or overestimate strategy use (Boekaerts & Corno, 2005; Larkin, 2009; van Hout-Wolters, 2009). To investigate intervention effects more accurately, further studies should combine self-report protocols with more qualitative methods (e.g., think-aloud measures, trace methodologies, observation of performance procedures) relevant to self-regulation processes and outcomes (Boekaerts & Corno, 2005; van Hout-Wolters, 2009; Winne, 2005; Zeidner et al., 2000). In this respect, the structured interview in the present study was a valuable supplement to the questionnaires, but not sufficient being a self-report measure itself. Since instruments assessing young children's SRL are scarce (Sperling et al., 2002; Winne & Perry, 2000), development and validation of both quantitative and qualitative instruments for this age group is a challenge for future research.

Self-regulated learning strategies

The quantitative analysis of the structured interview showed only significant effects for the occurrence of seeking social assistance from teachers and adults in sixth graders' reports. In order to analyse the structured interview, both quantitative and qualitative analyses were conducted. Although the quantitative results show no further significant differences regarding other self-regulatory strategies of fifth and sixth graders, the qualitative analysis shows a considerable shift in the way students approach SRL strategies. Due to the intervention, students refined and expanded their repertoire of strategies, moving from rather superficial to more structured, systematic, and deeper learning strategies. This finding corroborates that SRL can be enhanced through instruction and training (Dignath & Büttner, 2008; Perels et al., 2005). It is worthwhile to notice that the strategies with a substantial shift from pretest to posttest overlap largely with those addressed explicitly during the intervention (e.g., mind mapping, highlighting main issues, mnemonics, self-reflection and self-evaluation, use of a dictionary). In this study, the qualitative analysis of SRLIS appeared to be more appropriate to investigate the intervention effects. In this respect, we advise further researchers not only to perform quantitative analyses involving numerical rates of occurrence, but also to perform qualitative analysis of the nature of the reported strategies.

In addition to the discussed limitation regarding the measurements, recommendations on the design can be made as well. Although the current study illustrates some beneficial effects of student tutoring on SRL, further research is needed to verify these results. First, this study did not incorporate a control group and only outlined a rather short-term effect. A quasi-experimental study with a pretest, posttest, and retention test control group design would be valuable for future research. Further, larger-scale investigations are needed to verify the results of the present study to provide additional evidence to the hypothesis that student tutoring can be a beneficial tool improving fifth and sixth graders' SRL.

Conclusion

This study investigated the effectiveness of student tutoring and illustrates some beneficial effects on SRL, while advocating the need for more comprehensive research in this research area. The specific approach of this study has implications for two research fields. First, it specified that student tutoring can be beneficial to enhance cross-curricular skills, namely SRL. This is an innovative scope within this research field. Second, the study provides more insight into the emerging research area studying SRL behaviour of primary school students. Moreover, the results confirm the possibility to improve SRL among primary students by training self-regulatory components. With respect to future research, the importance of a multi-method design, the requirement of a variety of protocols to paint a full portrait of SRL (Boekaerts & Corno, 2005; Winne, 2005), and the need for development and validation of quantitative and qualitative instruments to study young children's SRL are stressed.

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Appendix

Overview of the intervention content

Session	Content	SRL component[a]	Example of activities
1	Self-reflection on one's own learning	Metacognitive and motivational component	Identifying personal strengths and weaknesses in study behaviour
2	SRL cyclical phases: use of forethought, performance control, and self-reflection processes. Operationalised as: task definition; goal setting and planning; execution of the task and monitoring; global evaluation	Metacognitive component	Performing an activity according to a step-by-step plan
3	Goal setting, time-management and environmental structuring	Metacognitive component	Estimating duration of a task and comparison with actual time-use
4	Activating prior knowledge, text comprehension, asking questions	Cognitive component	Predicting the content of a text by scanning
5	Distinguishing main issues from side-issues, structuring texts through indicating keywords	Cognitive component	Highlighting key words in text
6	Representing texts schematically through mind mapping	Cognitive component	Making a mind map of a text.
7	Memorising techniques	Cognitive component	Practicing mnemonics techniques
8 +9	Preparing an oral presentation about a self-selected theme [b]	Motivational, metacognitive and cognitive component	

Note: [a]The different components of SRL are explicitly addressed during particular sessions. Moreover, the metacognitive and motivational component are integrated throughout all sessions. Regarding the motivational component, it is expected that the affective processes during tutoring (e.g., trusting relationship with a tutor, modelling of enthusiasm, receiving more praise and encouragement than in group instruction, and the extra personal attention itself) will foster greater learning motivation, self-esteem, and self-confidence (Topping & Ehly, 2001). Therefore, the motivational component is not explicitly addressed during a particular session, but is embedded in the process of tutoring throughout all sessions.
[b] Following the statement of Perry et al. (2004) that complex tasks are effective forms promoting SRL, the last two sessions were reserved for a complex assignment giving students the opportunity to integrate and apply the learned self-regulated strategies.

3 Measuring the complexity of late primary school children's self-regulated learning: A multi-component approach

This chapter is based on:

Vandevelde, S., Van Keer, H., & Rosseel, Y. (2013). Measuring the complexity of upper primary school children's self-regulated learning: A multi-component approach. *Contemporary Educational Psychology, 38*, 407-425. doi: 10.1016/j.cedpsych.2013.09.002

Chapter 3
Measuring the complexity of late primary school children's self-regulated learning: A multi-component approach

Abstract

Balancing theoretical and practical issues in the measurement of SRL remains a challenge. This is especially the case for large-scale studies among primary school children's SRL. In this respect, the present study describes the development and validation of the Children's Perceived use of Self-Regulated Learning Inventory (CP-SRLI) consisting of nine components. A multistep process was used to develop the questionnaire, including reviews by a teacher and expert panel, cognitive interviews with late primary school children, and a large-scale administration. The original 109-item questionnaire was then presented to 504 fifth and 463 sixth graders (sample 1). Subsequent to exploratory factor analyses on each component, the factor structure of each component was confirmed by confirmatory factor analyses using an independent second sample (409 fifth and 314 sixth graders), leading to a questionnaire of 75 items. Further, the factor structure of the different components is found to be invariant across boys and girls. The implications of the results and potential avenues for future research are presented and discussed.

Introduction

In the past decades, the concept of self-regulated learning (SRL) has received a great deal of attention in educational research and educational psychology leading to a diversity of models, conceptions, and definitions of SRL (e.g., Boekaerts & Corno, 2005; Martin & McLellan, 2008; Paris & Paris, 2001; Perry, Phillips, & Dowler, 2004; Schunk, 2005). An often cited definition is the one of Zimmerman's (1990) which describes learners as self-regulatory to the degree that they are metacognitively, motivationally, and strategically active participants in their own learning. From a more cognitive and information processing perspective, Winne (1996) views SRL as a metacognitively governed behaviour, wherein learners adaptively regulate their use of cognitive tactics and strategies in tasks. Boekaerts (1999) also incorporates an affective component by describing SRL as a series of reciprocally related cognitive and affective processes that operate together on different components of the information processing system. Based on general assumptions shared by different models of SRL, Pintrich describes SRL as "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behaviour, guided and constrained by their goals and the contextual features in the environment" (Pintrich, 2000, p. 453). This description – which also serves as the theoretical basis for the present study - illustrates the complexity and multi-component character of SRL, including a metacognitive, cognitive, and motivational component as key components of SRL. In terms of metacognitive activities, self-regulated learners plan, set goals, organise, self-monitor, and self-evaluate at various points during the learning process (Boekaerts, 1999; Pintrich, 2004; Zimmerman, 1990). The strategic or cognitive component refers to various learning strategies and tactics students select and apply (Azevedo & Cromley, 2004; Boekaerts, 1999; Hadwin, Wozney, & Pontin, 2005; Pintrich, 2004; Winne, 2001) and to how they select, structure, and create environments optimising learning (Perry et al., 2004; Zimmerman, 1990). A growing body of research indicated that a student's use of (meta)cognitive strategies is not merely a matter of skills, but also of motivation (Boekaerts, 1995; Pintrich, 1999; Wolters, 2003; Zimmerman & Moylan, 2009). Consequently, SRL involves an important motivational component as well, including intrinsic motivation, self-efficacy beliefs, task interest, and self-attributions, as well as strategies to regulate motivation and affect (Pintrich, 2004; Wolters, 2003; Zimmerman, 2000).

As numerous studies have indicated that SRL leads to success in and beyond school (Artelt, Baumert, McElvany, & Peschar, 2003; Pintrich, 2004; Schunk, 2005; Winne, 2005; Zimmerman, 2002), SRL has become an important educational goal (Boekaerts, 1999). Until recently the dominant view was that young children (i.e., preschool and early primary school children) are unable to self-regulate their learning (Paris & Newman, 1990; Schunk, 2001; Zimmerman, 2001) and that important self-regulatory skills, like metacognitive skills, only emerge at the age of 8 to 10, and expand during the years thereafter (Alexander, Carr, Schwanenfugel, 1995; Veenman, van Hout-Wolters, & Afflerbach, 2006). Consequently, the main focus of research on SRL was on secondary and high school students and comparatively few studies addressing primary school children's SRL have been conducted (e.g., Winne & Perry, 2000; Zeidner, Boekaerts, & Pintrich, 2000). More recently, however, progressively more research has been reported that counters this dominant view by revealing that young children can and do engage in SRL-activities (Annevirta & Vauras, 2006; Bronson, 2000; Perry, 1998; Perry et al., 2004; Schneider & Lockl, 2002; Whitebread et al., 2009; Wigfield, Klauda, & Cambria, 2011). Given these recent findings, it can be assumed that SRL develops during preschool or early-school years at a basic level, and becomes more sophisticated and academically oriented as children proceed their primary school years and further school career (Bronson, 2000; Dignath & Büttner, 2008; Veenman et al., 2006; Zimmerman, 2001).

Although SRL is considered as a highly preferable skill, a large number of learners encounter difficulties to regulate their learning (e.g., Perry et al., 2004; Pintrich, 2004; Winne, 2005; Zimmerman, 2002) and the degree of efficiency in using self-regulatory strategies largely varies among learners (Annevirta & Vauras, 2006; Hong & Peng, 2008; Veenman et al., 2006). Although children in most cases do not spontaneously or effectively regulate their learning (Boekaerts, 1997; Schneider, 2008; Schunk, 2001), research indicates that SRL can be fostered by instructional guidance already at primary school by training components, explicitly strategy instruction, and through participation in environments that provide learners with opportunities to be in control of their own learning (Dignath & Büttner, 2008; Paris & Paris, 2001; Perels, Gürtler, & Schmitz, 2005; Schneider, 2008; Stoeger & Ziegler, 2008; Zimmerman, 2002). From an educational point of view, these findings open promising perspectives for successful interventions aimed at improving self-regulatory skills (De Corte, Mason, Depaepe, & Verschaffel, 2011). Additionally, it is argued that SRL and fostering SRL becomes increasingly important in transition periods in which students switch from a more closely monitored environment, like primary education, to an environment, like secondary education, in which they are expected to engage in more independent study time, are assigned more homework assignments, and must be able to manage different assignments from multiple teachers (Butler, 2002a; Cleary & Zimmerman, 2004; Dembo & Eaton, 2000; Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013; Wintgate, 2007). To meet these expectations, students need a repertoire of self-regulatory learning strategies they can access and utilise. Unfortunately, however, research has indicated that as students make the transition to secondary school, many of them develop negative self-motivational beliefs, like decreasing self-efficacy beliefs regarding their self-regulatory learning (Corpus, McClintic-Gilbert, & Hayenga, 2009; Eccles, 2005; Pajares & Valiante, 2002; Spinath & Spinath, 2005; Usher & Pajares, 2008). This is problematic, because as students lose motivation for and confidence in their academic strategies and practices, they are less likely to employ them and will struggle to deal with the academic demand for greater self-management.

These findings underline the importance of effectively promoting SRL in primary education (Dignath & Büttner, 2008; Perry et al., 2004; Postholm, 2010; Stoeger & Ziegler, 2011) and in this way preventing children from developing negative and academically ineffective learning habits and beliefs (Dignath & Büttner, 2008; Perry et al., 2004). Moreover, early adolescence represents a critical moment for the establishment of a good study method which they will need when confronted with the more complex study requirements that students will meet in the following years (Meneghetti, De Beni, & Cornoldi, 2007). In line with this, the present study focuses on late primary education, and more specifically on fifth and sixth graders, since at this age children are approaching the transition from primary to secondary school in Flemish education.

In order to foster SRL in primary school, it is however important to first gain more insight into the self-regulatory learning strategies of late primary school children and in how they perceive their efforts to regulate their learning.

Challenges in measuring SRL

The aim of the present study is to develop and (initially) validate a set of scales comprehensively assessing late primary school children's perceptions of SRL activities and their engagement within them in academic homework contexts. Such research is warranted for several reasons.

First, as stated above, research on primary school children's SRL remains limited, and this is especially the case for large scale studies (Cooper & Corpus, 2009; Wigfield & Eccles, 2000; Winne & Perry, 2000). This empirical shortage is connected to the current need for valid measures of children's SRL (Winne & Perry, 2000). In the literature, several methods have been used to measure SRL among younger students, including questionnaires (e.g., Perels et al., 2005), structured interviews (e.g., Swanson, 1990; Zimmerman & Pons, 1986), observations (e.g., Dermitzaki, Leondari, & Goudas, 2009; Perry, 1998; Whitebread et al., 2009), teacher ratings (e.g., Zimmerman & Martinez-Pons, 1988), think-aloud methods (e.g., Jacobse & Harskamp, 2012), and trace methodologies (e.g., Perry & Winne, 2006).

These methods can be clustered into on-line and off-line methods. Off-line methods are presented either before or after task execution, whereas on-line assessments are obtained during task performance (van Hout-Wolters, 2009; Veenman, 2005). All these assessment methods have their advantages and disadvantages. On-line methods, like think-aloud protocols, observations, or computer-collected trace information, are useful to capture relevant processes at a very microlevel in terms of the actual events or tactics used by students while studying and learning. The major advantage of these methods is that they give information about the learning activities at the moment they take place, making the information less vulnerable to students' memory distortions (Veenman, 2011).

Besides this positive characteristic, on-line methods also have their limitations. For example, think-aloud protocols may not be complete when learners do not or cannot verbalize all ongoing thoughts. Especially younger students (i.e., preschool or early-school years children) may not have a vocabulary that is sufficiently rich to describe their inner thoughts (Boekaerts & Corno, 2005). In addition, the extra task of reporting one's cognitions and feelings can lead to working memory overload, resulting in either incomplete protocols or interference with their performance on the task (Boekaerts & Corno, 2005; Whitebread et al., 2009). In this respect, it has been argued that observational techniques are more appropriate to assess SRL among young children who are not verbally fluent (e.g., preschool and early primary school children) (Perry, Thauberger, & Hutchinson, 2010; Whitebread et al., 2009). However, observations may only capture easily perceivable activities or overt behaviour, and not the thoughts and motives underlying that behaviour (van Hout-Wolters, 2009; Veenman, 2005, 2011). Moreover, from a practical point of view, on-line methods are very time and labour-intensive methodologies, making them less suitable for use in larger samples.

In comparison, off-line methods, such as self-report questionnaires, are relatively easy to administer and score (Cromley & Azevedo, 2011; van Hout-Wolters, 2009; Winne & Perry, 2000). Furthermore, by using self-report measures learners are not disturbed during studying or task performance (van Hout-Wolters, 2009). However, self-report tools measuring SRL behaviour have often received criticism as students seem to under- or overestimate their strategy use leading to low correlations between students' reports and their actual SRL behaviour (Boekaerts & Corno, 2005; Cromley & Azevedo, 2006; Schellings & van Hout-Wolters, 2011; van Hout-Wolters, 2009; Veenman, 2011). As self-report instruments ask respondents to report on the extent to which they apply particular strategies, students have to retrieve earlier processes and performance from their long term memory. This reconstruction process might suffer from memory failure and distortions (Boekaerts & Corno, 2005; McNamara, 2011; Nisbett & Wilson, 1977; Schellings, 2011; Wirth & Leutner, 2008). As such, students may (a) have forgotten certain learning activities, (b) mention learning activities that did not take place, (c) be unaware of the learning activities executed or unable to reflect effectively in order to complete the questionnaire correctly, or (d) report strategy use because they know or believe some strategies to be effective and not because they actually use those strategies (Samuelstuen & Braten, 2007; van Hout-Wolters, 2009). Additionally, self-report instruments can elicit socially desirable answers (Cromley & Azevedo, 2011; van Hout-Wolters, 2009; Veenman, 2005).

However, researchers have also been acknowledging the value of self-report data, as it provides insight into self-perceived propensities of using a particular tactic or strategy when learning (Perry & Winne, 2006; Pintrich, 2004; Richardson, 2004; Zimmerman, 2008). In order to empower students to productive SRL, research stresses the significance of considering students' perceptions about SRL activities next to their actions (Credé & Phillips, 2011; Pajares & Valiante, 2002; Perry & Rahim, 2011; Turner & Patrick, 2008). Students' own views of how they study are important in SRL, because students are agents regulating learning in relation to their interpretations about their behaviour and its effects (Winne, 1997; Winne & Jamieson-Noel, 2002). Moreover, insight in students' perceptions and beliefs about their self-regulatory practices can also serve as a valuable steppingstone to design and set up interventions regarding SRL (Pajares, 2002).

Concluding, when researchers want to conduct large-scale studies, they face the challenge of finding viable measures meeting the constraints of being deliverable to many students in a fairly brief amount of time and at the same time providing a valid assessment of SRL (McNamara, 2011). Moreover, as each measurement has its advantages and disadvantages, researchers advise to combine multiple means of operationalising and measuring SRL (Boekaerts & Corno, 2005; van Hout-Wolters, 2009; Veenman, 2005; Zimmerman, 2008). In order to make the measurement of primary school children's SRL more practicable and to allow researchers to combine on-line methods with a self-report measure, further research aiming at the development of more precise measures is needed. Therefore, we aim to develop a coherent set of self-report measures in order to triangulate with other types of SRL measures.

A second reason to develop and validate a set of scales comprehensively assessing SRL, has to do with the age group existing questionnaires aim at and with the specific strategies they address. Although several self-report questionnaires are available to assess SRL in older students (e.g., ALSI, Entwistle & McCune, 2004; LASSI, Weinstein, Schulte, & Palmer, 1987; GOALS-S, Downson & McInerney, 2004; MAI, Schraw & Dennison, 1994; MSLQ, Pintrich, Smith, Garcia, & MacKeachie, 1993, R-SPQ-2F, Biggs, Kember, & Leung, 2001), the choice of self-report instruments for measuring primary school children's SRL is, however, far more limited (e.g., Jr. MAI, Sperling, Howard, Miller, & Murphy, 2002; PALS, Midley, Kaplan, Middelton, & Maehr, 1998) (Winne & Perry, 2000).

Although these instruments have their merits for particular research goals, most existing assessment methods, both for younger and older students, are not aimed at the full spectrum of SRL, but are restricted to a subset of strategies (Butler, 2002b; Dowson & McInerny, 2004; Schellings, 2011; Wirth & Leutner, 2008), such as learning and/or metacognitive strategies. For example, the Jr. MAI (Sperling et al., 2002) focuses on metacognition and the PALS (Midley et al., 1998) assesses students' goal orientation. In consequence, if researchers - in line with the current literature – want to assess the multitude of aspects in primary school children's SRL, they are required to apply different instruments to assess the constructs relevant to their research. These scales, however, are often developed from modestly different theoretical frameworks and also use different instructions and response formats (Muis, Winne, & Jamieson-Noel, 2007). Moreover, the scales may have different psychometric properties that are unknown until after the data have been gathered. In the light of a specific one-time use some researchers have composed a questionnaire by combining different scales or developed a new instrument (e.g., Hong, Peng, & Rowell, 2009; Otto, Olyai, Buettner, & Krajewski, 2011; Perels et al., 2005; Seegers, van Putten, & de Brabander, 2002; Stoeger and Ziegler, 2008). However, limited information about the psychometric properties is reported, which makes it difficult for other researchers to judge the value of these measurements. Therefore, a comprehensive instrument covering the key components of SRL is needed (Cascallar, Boekaerts, & Costigan, 2006; Vandevelde, Van Keer, & De Wever, 2011; Wirth & Leutner, 2008). To our knowledge, this kind of instrument to assess SRL among late primary school children is, however, not available in the literature so far. Therefore, the current research focuses on the development and (initial) validation of a comprehensive set of scales to capture the multi-component character of SRL from a clear theoretical framework and with parallel instructions and comparable response formats.

Third, optimal SRL instruction requires the consideration of students' individual differences regarding their self-regulatory activities (Boekaerts & Corno, 2005; Postholm, 2010; Schunk & Ertmer, 2000; Winne, 2005). Consequently, teachers should build from students' initial SRL to adapt their classroom practice and make students more inductive for SRL. Unfortunately, however, SRL is rarely incorporated into school-based assessments (Cleary, 2006). Even though teachers value information about students' SRL in the light of developing classroom-based interventions, they rarely receive this type of information, partly due to the paucity of SRL measures that comprehensively assess primary school children's SRL (Askell-Williams, Lawson, & Skrzypiec, 2012; Cleary, 2006).

Finally, as recent research stresses a context-specific assessment of SRL (Hadwin, Winne, Stockley, Nesbit, & Woszczyna, 2001; Veenman et al., 2006; Winne & Perry, 2000), the present self-report questionnaire focuses on the context of academic homework. In Bembenutty (2011) Cooper defines homework as tasks assigned to students by school teachers that are meant to be carried out during non-instructional time. It has been argued that homework can enhance the development of self-regulation processes and self-beliefs (Cooper & Valentine, 2001; Pintrich, 2000; Ramdass & Zimmerman, 2011). In the early school years, teachers play a major role in regulating students' learning. However, as students advance to higher grades, teachers gradually reduce that support and expect students to incorporate self-regulatory processes in assignments that are done independently, such as homework (Trautwein & Köller, 2003; Zimmerman, 2002). During homework, students have the opportunity to engage in self-regulation by motivating themselves, setting goals, inhibiting distractions, delaying gratification, using strategies to complete homework, managing time, and monitoring and evaluating their performance (Bembenutty, 2009b; Boekaerts, 1999; Corno, 1994; Ramdass & Zimmerman, 2011). As such, homework behaviour is closely associated with the three key components of SRL, namely the motivational (e.g., believe in one's capacities and value of homework and maintaining motivation), cognitive (e.g., selecting and applying appropriate strategies) and metacognitive component (e.g., goal setting, monitoring, and evaluating) (Kitsantas & Zimmerman, 2009; Ramdass & Zimmerman, 2011; Stoeger & Ziegler, 2011; Trautwein & Köller, 2003).

Theoretical model of SRL

As SRL has been studied from several viewpoints in psychology and education (Boekaerts & Corno, 2005), it is important to carefully articulate the theoretical basis of newly developed instruments (Cascallar et al., 2006; Wirth & Leutner, 2008). Different theoretical models of SRL have emerged in the literature, such as Zimmerman's (2000) model, Winne and Hadwin's (1998) four-stage model of SRL, and Boekaerts' (1997) six component model of SRL. Although these models share some general assumptions (Pintrich, 2000, 2004), they differ in the aspects of SRL emphasised (Puustinen & Pulkkinnen, 2001; Winters, Greene, & Costich, 2008; Wirth & Leutner, 2008). In order to develop a valid instrument assessing SRL, a coherent framework integrating the general assumptions and features of the different models is necessary (Wirth & Leutner, 2008).

In this respect, Pintrich (2000, 2004) has provided a conceptual framework considering SRL as an interaction between cognitive, metacognitive, and motivational aspects. The model displays a framework classifying different phases and areas of regulation. The four phases are processes that many models of SRL share and they reflect (a) forethought, planning, and activation; (b) monitoring; (c) control; and (d) reaction and reflection (Pintrich, 2004). These planning, monitoring, control, and regulation processes reflect the metacognitive component of SRL and can be applied to four areas, namely cognition, motivation, behaviour, and context. As the framework reflects the phased structure and the multi-component character of SRL, it is a valuable blueprint for the development of a new comprehensive measurement instrument.

Moreover, Wirth and Leutner (2008) have argued that off-line methods are theoretically based on component models of SRL which describe SRL in terms of different learner competencies that foster SRL. Pintrich's (2000) framework can be considered as a component model (Wirth & Leutner, 2008). However, this framework was initially developed for assessing college students' SRL. As our target group is late primary school students, adaptation, and more specifically simplification, of the model was warranted. In doing so, we conceptualise SRL as a powerful construct describing various components that are part of successful learning and explaining the reciprocal and recurrent interactions between and among the different components (Boekaerts, 1999). As such, the adjusted conceptual framework can also be considered as a component model as it describes various competencies, like performing a task analysis, making a planning, monitoring progress, all contributing to successful regulation of one's learning.

More concretely, the following steps were undertaken to adjust Pintrich's model to the primary school context. First, based on a thorough literature review and taking the model of Pintrich (2000, 2004) as a blueprint, it was evaluated which components most models of SRL consider as most substantial components within SRL hereby securing the key characteristic of Pintrich's (2000) framework, namely the interaction of cognitive, metacognitive, motivational and behavioural elements. Second, guided by developmental research, special attention was given to which self-regulatory activities can be expected among late primary school children. For example, 'change or renegotiate task' was not incorporated into the adjusted framework as – in traditional classrooms – students may have little opportunities to engage in contextual control and regulation especially in primary education where the teacher controls most of the aspects of the tasks and context (Pintrich, 2000). As such, an adjusted theoretical framework was developed entailing nine components. Third, in order to ensure that the included components reflect the multi-faceted character of SRL in an appropriate way, the critical view of the expert panel and practice panel was also inquired on this matter. Table 1 gives an overview of the included components and their relation with Pintrich's (2000, 2004) conceptual framework. As can be seen in Table 1, the majority of the concepts of Pintrich's model are mirrored into the components of the adjusted framework. However, some of the aspects are addressed in detail and operationalised further by a complete subscale (e.g., motivation), while other elements are addressed to lesser extent and operationalised by a single item (e.g., ease of learning judgements, metacognitive knowledge activation). In the following paragraph, a more detailed description of the adjusted framework and his components is provided.

Table 1

Overview of the relationship between the model of Pintrich (2004, p. 390) and the components of the CP-SRLI

Phases	Areas of regulation				Related components CP-SRLI and description
	Cognition	Motivation/affect	Behaviour	Context	
Forethought, planning, and activation	Target goal setting Prior content knowledge activation Metacognitive knowledge activation	Goal orientation approach Efficacy judgements Ease of learning judgements, perceptions of task difficulty Task value activation Interest activation	Time and effort planning Planning for self-observation of behaviour	Perceptions of task Perceptions of context	Task orientation • Analysing task demands • Activation prior (content/metacognitive) knowledge • Perceptions of task (task difficulty, interest) Planning • Strategic planning • Time planning Motivation • External regulation • Introjected regulation • Identified regulation • Intrinsic motivation Self-efficacy for self-regulated learning • Judgements of capability to regulate learning and motivation
Monitoring	Metacognitive awareness and monitoring of cognition (FOKs, JOLs)	Awareness and monitoring of motivation and affect	Awareness and monitoring of effort, time use, need for help	Monitoring changing task and context conditions	Monitoring • Awareness and monitoring of cognition, motivation, behaviour and context/effort
Control	Selection and adaptation of cognitive strategies for learning, thinking	Selection and adaptation for managing motivation and affect	Increase/decrease effort Persist, give up Help-seeking behaviour	Change or renegotiate task Change or leave context	Learning strategies • Rehearsal strategies • Elaboration strategies • Organisational strategies Motivational strategies • Self-reinforcement • Positive self-talk • Interest enhancement Persistence • Persistence • Concentration
Reaction and reflection	Cognitive judgements	Affective reactions	Choice behaviour	Evaluation of task Evaluation of context	Self-evaluation • Evaluation of the learning outcomes • Evaluation of the learning process • Affective reactions

Task orientation

Prior to task execution, a self-regulated learner will analyse the task at hand by actively searching clues revealing task demands, by interpreting instructions and reflecting on the learning objectives (Broekkamp & van Hout-Wolters, 2007; Butler & Cartier, 2004; Desoete, 2008). In line with the task demands, students can activate prior content knowledge and metacognitive knowledge about themselves and the task (Boekaerts, 1997; Pintrich, 2004; van Hout-Wolters, Simons, & Volet, 2000). The activation of prior knowledge can occur spontaneously, but can also be done in a more planful and regulatory manner as well through various prompts and self-questioning activities (Pintrich, 2000). Task orientation can also be accompanied with perceptions of or feelings about the task (Meijer, Veenman, & van Hout-Wolters, 2006). For example, students can make predictions of the task's difficulty level, also referred to as ease of learning (EOL) judgements, drawn on both metacognitive knowledge of the task and metacognitive knowledge of oneself in terms of past performance (Desoete, 2008; Pintrich, 2000; Winne & Jamieson-Noel, 2003). These judgements are similar to self-efficacy judgements, although the emphasis is on the task rather than on the self (Pintrich, 2000). Although EOL judgements can already be accurate in young primary school children, there are subtle improvements over the primary school years (Schneider & Lockl, 2002).

In the light of further task performance, it is important that students actively analyse task demands and build an adequate representation of the task requirements and learning goals. A profound orientation on the task provides students with the necessary information to align their strategies with the task requirements (i.e., planning) (Butler & Cartier, 2004; Veenman, 2005). This brings us to the next SRL activity, namely planning.

Planning

During planning students think in advance of how, when, and why to act in order to obtain the learning objectives, analysed during task orientation (Desoete, 2008). Typically it occurs before commencing a task, but it can also occur at any point during task execution, for example before starting a subsequent subtask (Pintrich, 2000). Planning activities can be directed at strategic planning and/or time planning/management (Pintrich, 2004; van Hout-Wolters et al., 2000; Zimmerman, 2002). Strategic planning refers to selecting the most appropriate strategy given the learning objectives after considering various possible approaches (Broekkamp & van Hout-Wolters, 2007; van Hout-Wolters et al., 2000; Veenman, Elshout, & Meijer, 1997; Zimmerman, 2000). With regard to time management, students can list all the activities they must complete, use the bits-and pieces approach, prioritise activities, and allocate time for the different activities (Broekkamp & van Hout-Wolters, 2007; Dembo & Eaton, 2000; Pintrich, 2004). As part of time management, students also may make decisions and generate intentions about how they will allocate their effort and the intensity of their work regarding the different tasks (Pintrich, 2000, 2004). Consequently, a detailed action plan can be designed, containing goals and directions for the subsequent learning activities. Such an elaborated action plan is a steppingstone to more process monitoring and control during task performance as it helps students to keep track of the progress and help them decide whether it is necessary to adapt their strategies (Veenman & Spaans, 2005; Wigfield et al., 2011).

Demetriou (2000) states that a profound planning incorporating the strategies and actions needed to attain goals and subgoals, and a time plan that specifies when strategies and actions are to be applied is not present before the age of 9. Further, research showed that time management and procrastination even remains difficult for middle school students (Dembo & Eaton, 2000).

Motivation

The use of (meta)cognitive learning strategies is closely connected to motivation. It is not enough to know which strategies to use and how to use them, students must want to use them and maintain that willingness throughout the learning task as well (Weinstein, Husman, & Dierking, 2000). Consequently, motivation is an important aspect of SRL (Bronson, 2000; Wolters, 2003). Within his framework, Pintrich (2000, 2004) adopts the achievement goal theory which traditionally makes a distinction between mastery and performance goals. In the present study, we, however, want to focus on the reasons underlying learners' behaviour ('the why of certain behaviour'), rather than on the type of goals learners might focus on ('the what or the content of goal pursuit') (Deci & Ryan, 2000), as students can have different reasons for pursuing a particular goal (Urdan & Mestas, 2006). Therefore, we opt for conceptualising motivation for learning from the perspective of the Self-Determination Theory (SDT; Deci & Ryan, 2000). Over the last decade, SDT received an exponential increase in attention in the literature and has been established as a well-validated and coherent theoretical framework for the conceptualization and investigation of motivation in several contexts, including education (Deci & Ryan, 2004; Reeve, 2002; Vansteenkiste, Lens, & Deci, 2006). Additionally, SDT provides theoretical grounds for examining how social and environmental factors can facilitate high-quality forms of motivation and engagement in activities (Deci, Vallerand, Pelletier, & Ryan, 1991) and in doing so provides practical implications and guidelines for the educational context (see Reeve, 2006 for further reading). These guidelines show important parallels with guidelines regarding the promotion of SRL. In contrast, regarding the achievement goal theory, researchers acknowledged that a precise and consensual definition of achievement goals remains elusive (Pintrich, 2000; Urdan & Mestas, 2006) and some researchers even claimed that a revision of the achievement goal theory is needed (Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002). Moreover, Hulleman, Schrager, Bodmann, and Harackiewicz (2010) state – based on their meta-analysis - that there is a lack of both conceptual and operational consistency, which has resulted in an overall misalignment between theory and measurement.

More particularly, SDT has expanded the traditional distinction between intrinsic and extrinsic motivation by differentiating extrinsic motivation into types of regulation that vary in their degree of relative autonomy (Ryan & Deci, 2000a, 2000b). In doing so, SDT focuses on the quality of motivation rather than on the quantity of motivation (Ryan & Deci, 2000b). 'Intrinsic motivation' reflects behaviour that is undertaken for its own sake, enjoyment, and interest with a high degree of perceived internal control. In contrast, extrinsic motivation reflects an activity or behaviour undertaken for some instrumental value or external reason. The least autonomous form of extrinsic motivation is 'external regulation'. In this case, behaviour is prompted by external contingencies, such as rewards, punishments, and deadlines, and the contingencies or reasons for performing the behaviour have not been internalized at all. With regard to 'introjected regulation', a second type of extrinsic motivation, people engage in an activity to comply with internal pressure or to avoid of feelings of guilt and shame. It reflects the start of an internalization of values, but control is still perceived as being external to the person as he or she seeks approval from others. A more autonomous form of extrinsic motivation is 'identified regulation'. In this case, the learner has identified with the personal importance of a behaviour and has accepted its regulation as his or her own (Deci & Ryan, 2000; Ryan & Deci, 2000a, 2000b; Vansteenkiste et al., 2006). Research has shown that students who adopt more autonomous motivation (i.e., identified regulation and intrinsic motivation) display greater persistence, deeper learning, better performance, and better transfer (Deci & Ryan, 2000; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004).

Self-efficacy for self-regulated learning

Another motivational key concept regarding SRL, is self-efficacy. We specifically focus on self-efficacy for self-regulated learning, referring to students' confidence that they possess the self-regulated learning strategies required to succeed in school (Pajares & Valiante, 2002; Zimmerman & Kitsantas, 2005). This belief in one's self-regulatory capabilities is an important predictor of students' successful use of self-regulatory skills and strategies across academic domains. Students with high self-efficacy are more likely to choose to engage in activities, work harder, persist longer when encountering difficulties, use effective learning strategies, and demonstrate higher achievement (Linnenbrink & Pintrich, 2003; Schunk & Ertmer, 2000; Usher & Pajares, 2008). Pajares and Valiante (2002) found that primary school students have more confidence in their ability to use self-regulated learning strategies than did secondary school students.

Monitoring

As the task evolves, self-regulated learners will monitor their cognition, behaviour, motivation, and the context. Monitoring involves the ongoing on-task assessment of the quality of task performance and the degree of which performance is progressing towards a desired goal and, as such, informing the learner whether modification of learning activities is needed (Meijer et al., 2006; Moos & Azevedo, 2009; Whitebread et al., 2009). Metacognitive monitoring involves the on-line quality control of one's strategy use and progress (Moos & Azevedo, 2009). These monitoring activities provide the learner with information about the relative discrepancy between a goal and current progress toward that goal and information about the necessity of adapting strategies (Pintrich, 2000; van Hout-Wolters et al., 2000). Cognitive monitoring involves the awareness and monitoring of various aspects of cognition, such as comprehension monitoring, feeling of knowing and judgements of learning. These judgements may manifest themselves in a number of activities, such as individuals becoming aware that they do not understand something they just read or heard, or becoming aware that they are reading too quickly or too slowly given the text and their goals. Based on these judgements of learning, students can allocate their study time by attending selectively to relevant or more difficult aspects of a task (Schneider, 2008). In addition to cognitive monitoring, students can also monitor their motivation, by being aware of one's motivational beliefs and affect, and they can monitor the context by examining context conditions to determine whether they are changing (Pintrich, 2004). Finally, monitoring activities can also be directed at time management and effort (Azevedo & Witherspoon, 2009; Pintrich, 2000). Studies have documented that children are able to monitor their learning process from the time they enter school (von der Linden, Schneider, & Roebers, 2011), but although younger children can make accurate monitoring it does not always lead to appropriate self-regulation (Schneider, 2008).

Learning strategies

One of the central aspects of cognitive control and regulation is the actual selection and use of various cognitive learning strategies, such as rehearsal, elaboration, and organisational strategies (Pintrich, 2004; Weinstein et al., 2000; Weinstein & Mayer, 1986). Rehearsal strategies involve reciting, repeating the material aloud (i.e., shadowing) or copying the material, and are best used for simple tasks and to make sure that the material is transferred into the working memory for further study (Pintrich, Smith, Garcia, & McKeachie, 1991; Weinstein & Mayer, 1986).

Elaboration strategies are used to make information meaningful and to build connections between information given in the learning material and learners' prior knowledge (e.g., creating mental imagery, using mnemonic techniques, creating analogies, explaining the ideas to be learned to someone else, questioning and relating new information to prior knowledge) (Pintrich et al., 1991; Weinstein et al., 2000; Weinstein & Mayer, 1986).

Organisational strategies are used to construct internal connections among the pieces of information given in the learning material. Examples are sorting or clustering information, selecting main ideas, summarising, and outlining (Weinstein et al., 2000).

Besides the above mentioned classification of rehearsal, elaboration, and organisational strategies, other authors distinguish between surface-level strategies directed at a basic understanding and memory of learning materials (i.e., rehearsal strategies) and deep-level strategies (i.e., organisational and elaboration strategies) aimed at deep understanding, transformation, or application of information (Alexander, 2004; Broekkamp & van Hout-Wolters, 2007; Leutner, Leopold, & Den Elzen-Rump, 2007).

Alexander, Graham, and Harris (1998) asserted that as children gain experience, their strategy use becomes more efficient, effective, flexible and undergo a qualitative shift from lower-level strategies (e.g., reading parts) to deeper processing, like summarizing or concept mapping. In addition, Kron-Sperl, Schneider, and Hasselhorn (2008) state that multiple strategy use increases as a function of time and age.

Motivational strategies

Students cannot only regulate their cognition, but also their motivation. According to Wolters (2003) regulation of motivation can be described as the activities through which individuals purposefully act to initiate, maintain, or supplement their willingness to start, to provide work toward, or to complete a particular activity or goal (i.e., their level of motivation). Students can apply different strategies to regulate motivation (e.g., use of positive self-talk, self-reinforcement by promising themselves extrinsic rewards, trying to make the task more interesting, or increasing the task value). In all these cases, students attempt to change or control their motivation in order to complete a task in case they face boredom, difficulty in making progress, or distractions in the environment (Dembo & Eaton, 2000; Wolters, 2003). Students' use of motivational strategies should be positively associated with their motivation, effort, and performance (Wolters, 2003). Cooper and Corpus (2009) found that children's understanding that strategies can be used to effectively sustain motivation appears to increase through the primary school years. Moreover, they observed a shift from understanding only concrete strategies (like environmental structuring and self-consequating) to understanding mental strategies (like interest enhancement and self-talk strategies).

Persistence

In the monitoring and control phases of SRL, persistence is a behavioural indicator of self-regulatory capacity (Wigfield et al., 2011). It refers to the tendency to maintain focus and effort in a challenging learning context (Corno, 2011; Lens & Vansteenkiste, 2008). Delay of gratification, which is a strategy or process in which the individual postpones an immediate reward for a more valuable future reward, is connected to persistence. Transferred to educational settings, students put off immediately gratifying activities, like watching television or playing video games, for a larger long term reward, like being successful in class (Bembenutty, 2009a; Wigfield et al., 2011). In addition, students can actively control or regulate their environment to make it more conducive for studying and to improve their concentration, like removing or minimising distractions or competing activities (Lens & Vansteenkiste, 2008; Pintrich, 2000). Based on previous studies, it appears that individual differences in persistence are more prevalent than developmental differences (Wigfield et al., 2011).

Self-evaluation

After task performance, students can engage in self-evaluation activities concerning the learning outcomes and the learning process, as well as make judgements in terms of affective reactions (Desoete, 2008; Meijer et al., 2006; Pintrich, 2000; van Hout-Wolters et al., 2000; Veenman & Spaans, 2005). These judgements and reflections can influence future behaviour when enacting a new learning task (Pintrich, 2000; Zimmerman, 2000). Regarding the evaluation of learning outcomes, students can check the correctness and the completeness of their performance. In case of evaluation of the learning process, students reflect on the execution of the action plan, the strategies used, and the effectiveness of a strategy in reaching a particular goal (Desoete, 2008; Whitebread et al., 2009). In addition, students may have emotional reactions to the task (e.g., perceived task difficulty) and the outcome (e.g., happiness at success, sadness at failure, self-efficacy) and can reflect on the reasons for the outcome (i.e., making attributions for the outcome) (Pintrich, 2004; Zimmerman, 2000). Most preferably they make strategy attributions instead of ability attributions (Zimmerman, 2000). Empirical studies reveal that 7 to 8 year-old children rarely reflect on their own performance and seldom evaluate their cognitive abilities as compared to 11- to 12-years-olds (Paris & Newman, 1990).

In short, self-regulated learners will carefully plan their learning activities before they initiate a specific task. The starting point is profoundly analysing the task at hand (e.g., What is the task about?) and considering personal features (e.g., What knowledge can I apply? Do I find the task interesting?). Subsequently, goals are set and plans are devised in order to enact tactics and strategies. As the task evolves step by step, self-regulated learners (a) implement effective learning strategies to organize, code, and rehears information; (b) maintain motivation using various motivational strategies and persist despite hindrances; (c) establish a productive learning environment; (d) monitor engagement in relation to the goals and identify deviations from paths they planned; and (e) fine tune or adapt their strategies to control their cognition, motivation, behaviour, and the context. Finally, self-regulated learners self-evaluate their performance and learning process and make adaptive attributions.

Gender differences and SRL

Several research studies explored the relation between students' gender and various aspects of SRL. More specifically, studies focused on gender differences in students' goal orientation (e.g., Kitsantas, Steen, & Huie, 2009; Middleton & Midley, 1997; Patrick, Ryan, & Pintrich, 1999; Smith, Sinclair, & Chapman, 2002), self-efficacy (e.g., Kitsantas et al., 2009; Pajares, 2002; Pajares, Miller, & Johnson, 1999; Usher & Pajares, 2008), learning approach and strategies (e.g., Donnon & Hecker, 2008; Furnham, Christopher, Garwood, & Martin, 2007; Wolters & Pintrich, 1998), and regulatory strategy use (Hong et al., 2009; Metallidou & Vlachou, 2007; Virtanen & Nevgi, 2010; Zimmerman & Martinez-Pons, 1990). Although there are indications of gender differences with respect to SRL, studies are inconclusive about the nature of these differences because the research yielded mixed results. Regarding self-efficacy, for example, some studies report higher self-efficacy scores for girls (e.g., Pajares et al., 1999), while other studies found no difference (Kitsantas et al., 2009). Accordingly, some researchers report higher levels of cognitive and regulatory strategy use for girls (e.g., Zimmerman & Martinez-Pons, 1990) while others report no gender differences (e.g., Metallidou & Vlachou, 2007). Some researchers argued that these differences may be a manifestation of response bias as boys and girls could respond to self-report instruments in a different way (Pajares, 2002; Pajares & Valiante, 2001; Pintrich & Zusho, 2007). Therefore, it is important to evaluate whether measuring students' perceptions regarding self-regulatory strategies is equally valid for males and females.

Aim of the study

Taken into account the shortcomings in prior research, the purpose of the present study is to develop and (initially) validate a comprehensive and coherent set of scales, which can be applied to (a) gain insight into late primary school children's perceived use of self-regulatory learning strategies in academic homework contexts and (b) to triangulate with other types of SRL measures diagnosing self-regulatory strategies. As SRL is a complex construct, the aim is to develop an instrument with a priori defined multiple scales corresponding to the nine component of SRL, as defined above, allowing to simultaneously examining the different components of SRL. Based on the literature, we expect a one-factor solution for the components 'task orientation', 'planning', 'monitoring', 'motivational strategies', 'persistence', and 'self-efficacy for self-regulated learning'. A two- factor solution is expected for 'self-evaluation' (i.e., product and process evaluation), a three-factor solution for 'learning strategies' (i.e., rehearsal, organisational, and elaboration strategies), and a four-factor solution for 'motivation' (i.e., external regulation, introjected regulation, identified regulation, and intrinsic motivation). Further, for each component, we aim to explore if the factor structure is invariant across boys and girls and if there are gender differences with respect to the different subscales.

Method

Participants

Two samples were included in the present study. The first sample was used to investigate the underlying structure of the items using exploratory factor analysis (EFA). Data from the second sample were used to confirm the stability of the exploratory factor structure by means of confirmatory factor analysis (CFA).

Sample 1

504 fifth (52.10%) and 463 sixth graders (47.90%) from 46 classes from 42 randomly selected Flemish (Belgium) primary schools participated, with a mean age of all participants being 11.62 (*SD* = .64). All students from the selected classes participated in the study. The participants were predominantly (85.6%) native Dutch-speaking and middle-class students. Gender was evenly distributed across both grades (χ^2 = 0.03, *df* = 1, *p* = .859, see Table 2).

Sample 2

409 fifth (56.57%) and 314 sixth graders (43.43%) from 45 classes from 17 inner-city Flemish (Belgium) primary schools participated, with a mean age of all participants being 10.93 (*SD* = .78). The participants were predominantly (68.9%) native Dutch-speaking. All students from the selected classes participated in the study. Gender was evenly distributed across both grades (χ^2 = 0.06, *df* = 1, *p* = .807, see Table 2).

Table 2
Gender distribution across samples and grades

	Sample 1		Sample 2	
Grade	Boys	Girls	Boys	Girls
5th grade	241 (47.91%)	262 (52.09%)	190 (46.50%)	219 (53.50%)
6th grade	225 (48.49%)	239 (51.01%)	143 (45.50%)	171 (54.50%)
Total	466 (48.19%)	501 (51.81%)	333 (46.06%)	390 (53.94%)

Instrument and procedure

In line with recommendations (Downing, 2006; Schmeiser & Welch, 2006; Worthington & Whittaker, 2006), we used a multistep process to develop the questionnaire. First, the various components of SRL were carefully selected and defined based on the model of Pintrich (2000, 2004) and SRL-literature providing the theoretical basis for the development of an initial item pool. Second, the items were reviewed by an expert panel and a primary school teacher panel to assess whether the items were both content valid, covering SRL strategies and behaviour feasible for primary school children, and worded clearly. Third, cognitive interviews were performed to assess the cognitive validity of the self-report items. Fourth, a large-scale item tryout was conducted to examine the factor structure using exploratory and confirmatory factor analysis. Further, tests of measurement invariance were conducted to determine whether the factor structure is invariant across gender and gender differences were explored. Finally, internal consistency was computed.

Item development

As described above, the conceptual framework of Pintrich (2000, 2004) was the blueprint for the item development and nine components were included. Items for each component were constructed based on current definitions and operationalisations in the literature and inspired by items in existing instruments. As most existing self-report questionnaires target older students (e.g., MSLQ, MAI), special attention was given to ensure that the wording, phrasing, and references to specific learning contexts were adequate for late primary school children. First, the phrasing and wording in the current instrument is less complicated than in instruments targeted for older students. For example, the following item of the CP-SRLI was used to operationalise 'comprehension monitoring': 'During my schoolwork, I ask myself: 'Do I still understand everything?'. Items addressing a similar learning activity derived from the MAI or MSLQ are phrased in a less comprehensible manner for primary school children: 'I find myself pausing regularly to check my comprehension' (MAI) or 'When studying for this course, I try to determine which concepts I don't understand well'. Second, instruments for older students also reflect more sophisticated strategies than can be expected from younger students or refer to learning contexts typical for secondary or higher education. For example, 'When I study for this class, I pull together information from different sources, such as lectures, readings, and discussions.' (MSLQ, elaboration strategies scale), 'I try to change the way I study in order to fit the course requirements and instructor's teaching style.' (MSLQ, metacognitive self-regulation scale), 'I try to find a study partner of study group for each of my classes' (LASSI, study aids scale), or 'I use my intellectual strengths to compensate for my weaknesses' (MAI, regulation of cognition scale). Further, the items of the component 'motivation' were based on an adapted version of the academic self-regulation scale (Ryan & Connell, 1989), which had been successfully used in previous work (Vansteenkiste, Sierens, Soenens, Luyckx, & Lens, 2009). This process resulted in a first item pool of 93 items.

Item review

First, the items were reviewed by five researchers in the field of educational sciences, and specifically in SRL, to establish content validity. The experts were asked to evaluate how well the content of each individual item reflected its respective construct, as well as the representativeness of the complete item pool for each component. In this regard, experts were requested to, if needed, generate additional items that could enhance the representativeness of the entire item pool as well. Finally, they evaluated the clarity and grammatical adequacy of each item.

Second, a teacher panel of five practising primary school teachers commented on the clarity of the items and reviewed the items to guarantee suitability for late primary school children. During both panels the first author acted as discussion moderator. The reviewers of the panels agreed that the sets of statements were consistent with the underlying theoretical framework of SRL. Based on the comments and recommendations raised by teachers and experts, some item statements were refined (e.g., 'I'm good at changing my strategy' was adjusted to 'I'm good at changing my strategy when it doesn't work out during my schoolwork') and 15 additional items were included (e.g., 'I'm good at making my schoolwork, even if I find it boring or difficult', 'During my schoolwork, I think about reasons why it is important to complete this schoolwork').

Cognitive interviews

Since the complex task of constructing self-report instruments yielding valid and reliable scores can be further complicated by cognitive developmental issues when constructing instruments for children (Woolley, Bowen, & Bowen, 2004), additional cognitive interviews with 14 fifth and sixth graders were performed. Cognitive interviewing, or also called cognitive pretesting, is regarded as a powerful methodology to examine and advance the validity of self-report items for children (Woolley et al., 2004; Woolley, Bowen, & Bowen, 2006). Applying cognitive interviews to pretest self-report items provide rich data about whether children's interpretations of self-report items are consistent with researchers' assumptions and whether the items do not exceed their cognitive ability to read, interpret, and respond to the items (Karabenick et al., 2007; Woolley et al., 2006). During the cognitive interview the participants were asked to: (a) read the question aloud; (b) explain or paraphrase the question; (c) read the answer options and choose an answer; and (d) explain why he or she chose that answer (Karabenick et al., 2007; Woolley et al., 2006). Taken into account gender and mother language, a representative group of 7 fifth and 7 sixth graders (7 girls, 7 boys; 9 native, 5 non-native speakers) was randomly selected. These students did not participate in the large scale administration. For the majority of the items the children were able to interpret them correctly and to respond to them. Misinterpreted items were removed or slightly revised regarding wording and phrasing in order to facilitate understanding. For example, regarding the original item 'I'm good at checking my schoolwork' students referred to situations in which they ask other persons to check their schoolwork as well. As this interpretation was not in line with researchers' assumptions, the item was rephrased into 'I'm good at checking my schoolwork by myself', which more clearly refers to self-evaluation. Based on this review process, an item bank of 109 items was retained.

Large-scale administration

The instrument, named as Children's Perceived use of Self-Regulated Learning Inventory (CP-SRLI), was administered in the 46 classes (first sample) and 45 classes (second sample) by trained research assistants and in the presence of the class teacher. First, the rating scale was explained and example items were presented. In order to ensure the concentration of the respondents, two short breaks were included. Students were then asked to complete the questionnaire at their own pace and could, if necessary, raise questions regarding the meaning of the items. The items were scored on a 5-point Likert scale, ranging from 1 to 5. In total, the administration took one class period of 50 minutes.

Missing data and data distribution

The data of both samples was not normally distributed with skewness values ranging from -1.87 to 0.84 and from -2.09 to 0.94, and kurtosis values ranging from -1.28 to 4.13 and from -1.25 to 4.50 respectively. The percentage of missing data across the components for both samples were 0.58% (sample 1) and 0.40% (sample 2) respectively.

Data analysis

Following the procedures of Dowson and McInerny (2004), McCardle, Hadwin, and Winne (2012), McInerney, Marsh, and McInerney (1999), and Skinner, Kindermann, and Furrer (2009), the (uni)dimensionality of each item set related to the nine components was assessed separately using exploratory and confirmatory factor analyses.

First, EFA using maximum-likelihood extraction with promax rotation in SPSS were carried out to investigate the underlying structure of the items of each component. The participant-to-item ratio was 8.87 meeting the minimum ratio of 5:1 (Worthington & Whittaker, 2006). In order to determine the number of factors to retain, parallel analysis in R 2.13 (R Development Core Team, 2013) was used with the 95th percentile as the comparison baseline, and the number of random data sets was 1 000 (Henson & Roberts, 2006; Pohlmann, 2004). In addition, only factors with three or more items loading were retained (Costello & Osborne, 2005; Worthington & Whittaker, 2006). Successive exploratory factor analyses were conducted where items were removed when: (a) their pattern coefficients was below .32 on the principal factor, (b) they loaded at .32 or higher on two or more factors (i.e., complex pattern coefficients), (c) they loaded on a factor which was not retained based on parallel analysis, and (d) they loaded on a factor with less than three items (Tabachnick & Fidell, 2001; Worthington & Whittaker, 2006). Besides these rules of thumb, the theoretical relevance and importance of an item was taken into account. We illustrate this procedure regarding the component 'learning strategies'. A first EFA on the items regarding 'learning strategies' revealed a four factor solution with one factor containing only two items, which were removed (i.e., 'When studying, I make sure that I understand everything', 'If I don't understand something, I reread it'). In a successive analysis, two items (i.e., 'When studying, I use a scratch paper' and 'When studying, I look at titles or pictures to figure out the topic') were removed due to low loadings (.31 and .30 respectively). After removing these items, EFA showed a two-factor solution which was in line with the numbers to retain based on the parallel analysis and theoretically interpretable.

Second, confirmatory factor analyses (CFA) were conducted on each component examining the stability of the exploratory factor structure using lavaan package 0.4-9 (Rosseel, 2012). The number of participants per parameter ranged from 15 to 40 meeting the guideline that there should be 5 to 10 participants per parameter estimated (Worthington & Whittaker, 2006). All data available were used applying case-wise maximum likelihood (Wothke, 1998). Since data were not normally distributed, maximum likelihood estimation was use with robust standard errors and a scaled test statistic (Yuan & Bentler, 2000). In order to evaluate the model fit, we will report several fit indices: (a) the scaled chi-square and p-value, (b) the root mean square error of approximation (RMSEA), (c) the standardised root mean square residual (SRMR), (d) the comparative fit index (CFI), and (e) the Tucker-Lewis index (TLI). For RMSEA, a cutoff value close to .06 is required for a relatively good fit (Hu & Bentler, 1999), while a value lower than .08 indicates a reasonable model fit (Schreiber, Nora, Stage, Barlow, & King, 2006). Furthermore, Hu and Bentler (1999) stated that a value of SRMR of .08 or lower indicates a good fit. In addition, CFI and TLI should be above .90 to indicate an adequate fit (Browne & Cudeck, 1992). If CFA revealed a poor fit, modification indices were inspected in order to conduct model modifications to the original model (Schreiber et al., 2006).

Third, measurement invariance testing was performed to determine whether the measurement model for the several components was invariant across gender (Vandenberg & Lance, 2000). In addition, gender differences were explored. The first baseline model (model 1) was tested for equivalent factor structure (i.e. configural invariance). A good overall fit would indicate that boys and girls conceptualise the constructs in the same way and that the factor structure is equivalent for boys and girls (Cheung & Rensvold, 2002; Vandenberg & Lance, 2000). Additionally, the comparative fit indices for two additional models across boys and girls were examined. In the second model (model 2) loadings were constrained to be invariant across the groups (i.e., metric invariance). If metric invariance is supported, boys and girls are interpreting the items in the same way (Cheung & Rensvold, 2002; Vandenberg & Lance, 2000). In the third model (model 3) both loadings and intercept were constrained (i.e., scalar invariance). Scalar invariance is a precondition for the comparison of latent means across groups (Cheung & Rensvold, 2002; Vandenberg & Lance, 2000). As specific indicator, changes in CFI of .01 or less indicate that the invariance hypothesis is supported (Cheung & Rensvold, 2002).

Finally, as an estimator of internal consistency, structural equation model-based internal consistency coefficients were opted for, which are considered as a better estimator than coefficient alpha (Bentler, 2009).

Results

Exploratory and confirmatory factor analyses

The results of the exploratory and confirmatory factor analyses are reported per component.

Task orientation

As hypothesised, the EFA yielded a one-factor solution (see Table 3). The stability of this one-factor model revealed good model fit results (YB χ^2 = 22.24, *df* = 9, *p* = .008, CFI = .98, TLI = .96, RMSEA = .05 with a 90% confidence interval (CI) of .03 and .07, SRMR = .03).

Table 3

Pattern and/or structure coefficients of EFA and CFA concerning 'task orientation'

	EFA[a]	CFA[b]
Item	Factor I	Task orientation
TO1	.36	.49
TO2	.69	.67
TO3	.65	.69
TO4	.48	.61
TO5	.38	.42
TO6	.37	.52

Note. [a] Structure coefficients are not reported since only one factor is retained.

[b] Standardised coefficients are reported.

Planning

As shown in Table 4, EFA suggested a one-factor model. This one-factor model showed a good fit to the data (YB χ^2 = 37.51, *df* = 9, *p* < .001, CFI = .94, TLI = .91, RMSEA = .07 with a 90% CI [.05, .09], SRMR = .03).

Table 4
Pattern and/or structure coefficients of EFA and CFA concerning 'planning'

	EFA[a]	CFA[b]
Item	Factor I	Planning
PL1	.64	.64
PL2	.55	.61
PL3	.53	.52
PL4	.47	.39
PL5	.37	.45
PL6	.44	.59

Note. [a] Structure coefficients are not reported since only one factor is retained.
[b] Standardised coefficients are reported.

Motivation

In line with SDT (Deci & Ryan, 2000) and our hypothesis, EFA suggested a four-factor model for the item set of the 'motivation' component. Accordingly, the four factors were labelled as 'identified regulation', 'intrinsic motivation', 'extrinsic regulation', and 'introjected regulation' respectively (see Table 5). This four-factor model revealed acceptable model fit results (YB χ^2 = 274.28, *df* = 71, *p* < .001, CFI = . 92, TLI = . 90, RMSEA = .06 with a 90% CI [.06, .07], SRMR = .05).

Self-efficacy for self-regulated learning

With regard to the components 'self-efficacy', the EFA shows a two-factor solution whereas a one-factor solution was expected. The first factor, labelled as 'self-efficacy motivation', examines the extent to which students feel competent to regulate motivational aspects. The second factor, labelled as 'self-efficacy regulation', assesses the extent to which respondents feel competent to regulate their learning processes regarding cognitive and metacognitive aspects (see Table 6). Inspection of the modification indices of the suggested two-factor model indicated that the model fit could be further improved by allowing correlations between the residuals of two pairs of items (SEM1 and SEM2, SER1 and SER2). Items SEM1 and SEM2 both assess the ability to motivate oneself to start or finish a task, whereas SER1 and SER2 assess the capability to plan tasks. The results of the modified model show an acceptable model fit (YB χ^2 = 182.89, *df* = 63, *p* < .001, CFI = .93, TLI = . 91, RMSEA = .05 with a 90% CI [.04, .06], SRMR = .04).

Table 5

Pattern and/or structure coefficients of EFA and CFA concerning 'motivation'

	EFA[a]				CFA[b]			
Item	Factor I	Factor II	Factor III	Factor IV	Identified	Intrinsic	Extrinsic	Introjected
ER1	-.01 (-.02)	-.05 (-.06)	**.58 (.62)**	.13 (.28)			.70	
ER2	.04 (-.06)	.00 (-.08)	**.97 (.94)**	-.07 (.22)			.91	
ER3	-.04 (-.07)	.03 (-.05)	**.73 (.74)**	.03 (.22)			.74	
INR1	.04 (.350)	-.03 (.24)	-.01 (.20)	**.74 (.75)**				.68
INR2	-.07 (.30)	.00 (.24)	-.01 (.23)	**.83 (.80)**				.72
INR3	-.04 (.19)	.04 (.17)	.11 (.24)	**.48 (.50)**				.59
INR4	.23 (.42)	.03 (.29)	.01 (.11)	**.40 (.51)**				.56
IDR1	**.58 (.67)**	.12 (.48)	.01 (-.03)	.03 (.33)	.67			
IDR2	**.77 (.72)**	-.12 (.36)	-.05 (-.08)	.06 (.34)	.75			
IDR3	**.77 (.74)**	-.01 (.44)	.02 (-.05)	-.06 (.29)	.64			
IDR4	**.76 (.78)**	.07 (.51)	.02 (-.06)	-.04 (.32)	.73			
IM1	.24 (.57)	**.51 (.68)**	-.05 (-.10)	.04 (.31)		.44		
IM2	-.08 (.52)	**.98 (.94)**	-.01 (-.09)	.02 (.30)		.86		
IM3	.03 (.51)	**.83 (.83)**	.02 (-.06)	-.02 (.27)		.84		

Note. [a] Structure coefficients are between parentheses next to pattern coefficients. Primary pattern and structure factor coefficients are in boldface.
[b] Standardised coefficients are reported.

Table 6

Pattern and/or structure coefficients of EFA and CFA concerning 'self-efficacy for self-regulated learning'

	EFA[a]		CFA[b]	
Item	Factor I	Factor II	Motivation	Regulation
SER1	.13 (.49)	**.54 (.63)**		.69
SER2	.20 (.48)	**.42 (.56)**		.58
SEM1	**.77 (.77)**	.00 (.51)	.62	
SEM2	**.99 (.83)**	-.23 (.42)	.62	
SEM3	**.55 (.63)**	.12 (.49)	.46	
SER3	.30 (.57)	**.41 (.61)**		.63
SEM4	**.48 (.64)**	.23 (.55)	.64	
SER4	.06 (.42)	**.55 (.59)**		.58
SER5	-.03 (.34)	**.57 (.55)**		.49
SER6	-.01 (.33)	**.52 (.51)**		.54
SER7	-.17 (.20)	**.56 (.45)**		.47
SER8	.03 (.37)	**.52 (.54)**		.45
SER9	.11 (41)	**.46 (.53)**		.54

Note. [a] Structure coefficients are between parentheses next to pattern coefficients. Primary pattern and structure factor coefficients are in boldface.

[b] Standardised coefficients are reported.

Monitoring

Based on the theoretical framework, it was assumed that the item set for monitoring would be unidimensional. This assumption was not confirmed by the data structure and the solution of the first EFA was not theoretically interpretable or valuable. Therefore, EFA was rerun and forced on a single factor (see Table 7). Although item MT5 has low pattern coefficient, the item was retained because of the theoretical relevance. Based on first CFA of this one-factor model and modifications indices, the model was modified. After allowing the correlation between the residuals of items MT4 and MT5, which both refer to time management, the one-factor model showed a good fit to the data (YB χ^2 = 29.45, *df* = 13, *p* = .006, CFI = .98, TLI = .96, RMSEA = .04 with a 90% CI [.03, .06], SRMR = .03).

Table 7

Pattern and/or structure coefficients of EFA and CFA concerning 'monitoring'

	EFA[a]	CFA[b]
Item	Factor I	Monitoring
MT1	.63	.64
MT2	.60	.61
MT3	.66	.74
MT4	.40	.29
MT5	.28	.34
MT6	.40	.42
MT7	.65	.65

Note. [a] Structure coefficients are not reported since only one factor is retained.

[b] Standardised coefficients are reported.

Learning strategies

The results of EFA indicated two instead of three dimensions. As displayed in Table 8, the first factor of 'learning strategies' consists of items corresponding to organisational and elaboration strategies. Therefore, this factor was labelled 'deep-level learning strategies'. The other factor contained items referring to rehearsal strategies and was labelled 'surface-level learning strategies'. The CFA confirmed the suggested structure that was obtained from EFA. The results showed a good model fit (YB χ^2 = 201.87, *df* = 76, *p* < .001, CFI = .94, TLI = .93, RMSEA = .05 with a 90% CI [.04, .06], SRMR = .04).

Table 8

Pattern and/or structure coefficients of EFA and CFA concerning 'learning strategies'

	EFA[a]		CFA[b]	
Item	Factor I	Factor II	Deep-level	Surface
LSL1	-.02 (.35)	**.68 (.67)**		.68
LSL2	.29 (.47)	**.33 (.49)**		.62
LSL3	.01 (.31)	**.57 (.57)**		.66
LSL4	-0.75 (.38)	**.84 (.80)**		.75
LDL1	**.36 (.45)**	.17 (.37)	.59	
LDL2	**.64 (.62)**	-.02 (.32)	.71	
LDL3	**.53 (.49)**	-.04 (.22)	.47	
LDL4	**.50 (.49)**	-.02 (.26)	.56	
LDL5	**.55 (.55)**	.01 (.31)	.61	
LDL6	**.45 (.47)**	.05 (.29)	.59	
LDL7	**.60 (.54)**	-.12 (.21)	.55	
LDL8	**.47 (.53)**	.12 (.37)	.68	
LDL9	**.40 (.46)**	.12 (.34)	.57	
LDL10	**.46 (.48)**	.03 (.28)	.52	

Note. [a] Structure coefficients are between parentheses next to pattern coefficients. Primary pattern and structure factor coefficients are in boldface.

[b] Standardised coefficients are reported.

Motivational strategies

As shown in Table 9, EFA suggests a single factor structure. A first test of this one-factor model revealed poor model fit results. A correlation between the residuals of the items MOTS3 and MOTS4, both referring to looking forward to the end of the task, was added to further improve the model fit. The modified model yielded a good model fit (YB χ^2 = 22.72, *df* = 8, *p* = .004, CFI = .97, TLI = .94, RMSEA = .05 with a 90% CI [.03, .07], SRMR = .03).

Table 9

Pattern and/or structure coefficients of EFA and CFA concerning 'motivational strategies'

	EFA[a]	CFA[b]
Item	Factor I	Motivational strategies
MOTS1	.51	.54
MOTS2	.42	.44
MOTS3	.42	.31
MOTS4	.69	.57
MOTS5	.78	.73
MOTS6	.38	.40

Note. [a] Structure coefficients are not reported since only one factor is retained.

[b] Standardised coefficients are reported.

Persistence

As Table 10 indicates, EFA supported the unidimensionality of the item set regarding 'persistence'. This exploratory factor structure was confirmed by CFA revealing satisfactory model fit (YB χ^2 = 31.31, *df* = 9, $p < .001$, CFI = .98, TLI = .96, RMSEA = .06 with a 90% CI [.04, .08], SRMR = .03).

Table 10

Pattern and/or structure coefficients of EFA and CFA concerning 'persistence'

	EFA[a]	CFA[b]
Item	Factor I	Persistence
P1	.67	.71
P2	.68	.72
P3	.73	.78
P4	.77	.73
P5	.61	.59
P6	.66	.67

Note. [a] Structure coefficients are not reported since only one factor is retained.

[b] Standardised coefficients are reported.

Self-evaluation

As hypothesised, EFA suggested a two-factor model. Item content inspection suggested that the first factor denotes 'process evaluation' referring to the evaluation of learning processes. The other factor reflects the evaluation of learning outcomes, labelled as 'product evaluation' (see Table 11). This two-factor model was subsequently fitted to the data and CFA showed a good fit to the two-factor model (YB χ^2 = 95.91, *df* = 13, $p < .001$, CFI = .94, TLI = .90, RMSEA = .09 with a 90% CI [.08, .11], SRMR = .05).

Table 11

Pattern and/or structure coefficients of EFA and CFA concerning 'self-evaluation'

	EFA[a]		CFA[b]	
Item	Factor I	Factor II	Process	Product
SPROD1	.17 (.43)	**.52 (.60)**		.71
SPROD2	-.08 (.37)	**.87 (.83)**		.82
SPROD3	.03 (.36)	**.64 (.66)**		.75
SPROC1	**.75 (.75)**	.00 (.40)	.78	
SPROC2	**.78 (.75)**	.75 (.34)	.70	
SPROC3	**.66 (.71)**	.01 (.43)	.77	
SPROC4	**.45 (.46)**	.03 (.26)	.52	

Note. [a] Structure coefficients are between parentheses next to pattern coefficients. Primary pattern and structure factor coefficients are in boldface.

[b] Standardised coefficients are reported.

Measurement invariance testing and gender differences

Based on small changes in CFI, scalar invariance was confirmed for the majority of the components (see Table 12). For the components 'planning' and 'motivational strategies', only metric invariance was confirmed. Subsequently, tests of partial invariance were conducted to explore which items were not invariant across groups and these were removed from the original model (Vandenberg & Lance, 2000). Following items were removed: 'Before I start my schoolwork, I plan when I will do the different tasks', 'Before I start my schoolwork, I think of several ways to tackle the task and then choose the best one', 'If I no longer enjoy doing my schoolwork, I try to do something about it', and 'I say to myself: 'If I finish my schoolwork, then I am going to do something nice'.

After eliminating these items and based on small changes in CFI, scalar invariance could be established for the component 'planning' and 'motivational strategies' (see Table 13). The revised models showed good model fit results: 'planning' (YB χ^2 = 0.28, *df* = 5, *p* =.843, CFI = 1.00, TLI = 1.03, RMSEA = .00 with a 90% CI [.00, .03], SRMR = .01), 'motivational strategies' (YB χ^2 = 1.57, *df* = 2, *p* = .457, CFI = 1.00, TLI = 1.05, RMSEA = .00 with a 90% CI [.00, .06], SRMR = .01).

In conclusion, the final version of the self-report questionnaire comprises 75 items (see Appendix). In total, 34 of the original items were removed: 30 items based on EFA and 4 items in the light of measurement invariance tests (see Table 14 for more detailed information of number of items deleted per component).

Regarding gender differences, significantly lower scores were observed for boys on the following (sub)scales: planning (standardised factor score = .42, *p* < .001), self-efficacy regulation (standardised factor score = .18, *p* = .019), identified regulation (standardised factor score = .30, *p* < .001), persistence (standardised factor score = .23, p = .004), surface-level learning strategies (standardised factor score = .24, *p* = .003), deep-level learning strategies (standardised factor score = .28, *p* = .001), monitoring (standardised factor score = .19, *p* = .022), product evaluation (standardised factor score = .36, p = *p* < .001). In contrast, significantly higher scores were observed for boys regarding external regulation (standardised factor score = .28, *p* < .001). Task orientation (*p* = .073), introjected regulation (*p* = .074), intrinsic motivation (*p* = .055), self-efficacy motivation (*p* = .886), motivational strategies (*p* = .146) and process evaluation (*p* = .673) were equal across gender.

Table 12

Measurement invariance testing on the CP-SRLI: Summary of goodness of fit statistics

Measurement invariance tests		YB χ^2	*df*	*p*	CFI	RMSEA	ΔCFI
Task orientation							
Configural invariance (Model 1)		31.06	18	.028	.98	.05	
Metric invariance (Model 2)	Model 1 vs. Model 2	38.63	23	.022	.98	.04	.004
Scalar invariance (Model 3)	Model 2 vs. Model 3	49.63	28	.007	.97	.05	.010
Planning							
Configural invariance (Model 1)		45.49	18	.000	.93	.07	
Metric invariance (Model 2)	Model 1 vs. Model 2	60.86	23	.000	.93	.07	.020
Scalar invariance (Model 3)	Model 2 vs. Model 3	82.20	26	.000	.90	.07	.013
Motivation							
Configural invariance (Model 1)		351.71	142	.000	.92	.06	
Metric invariance (Model 2)	Model 1 vs. Model 2	361.69	152	.000	.92	.06	.000
Scalar invariance (Model 3)	Model 2 vs. Model 3	383.05	162	.000	.92	.06	.004
Self-efficacy SRL							
Configural invariance (Model 1)		257.08	124	.000	.93	.05	
Metric invariance (Model 2)	Model 1 vs. Model 2	267.00	135	.000	.93	.05	-.001
Scalar invariance (Model 3)	Model 2 vs. Model 3	256.14	146	.000	.92	.05	.005
Monitoring							
Configural invariance (Model 1)		52.15	26	.002	.96	.05	
Metric invariance (Model 2)	Model 1 vs. Model 2	57.30	32	.004	.96	.05	-.001
Scalar invariance (Model 3)	Model 2 vs. Model 3	64.95	38	.004	.96	.04	.002
Learning strategies							
Configural invariance (Model 1)		289.84	152	.000	.94	.05	
Metric invariance (Model 2)	Model 1 vs. Model 2	301.45	164	.000	.94	.05	.000
Scalar invariance (Model 3)	Model 2 vs. Model 3	321.39	176	.000	.94	.05	.004
Motivational strategies							
Configural invariance (Model 1)		31.01	16	.013	.97	.05	
Metric invariance (Model 2)	Model 1 vs. Model 2	34.52	21	.032	.97	.04	-.003
Scalar invariance (Model 3)	Model 2 vs. Model 3	47.34	26	.006	.95	.05	.018
Persistence							
Configural invariance (Model 1)		37.21	18	.005	.98	.05	
Metric invariance (Model 2)	Model 1 vs. Model 2	44.79	23	.004	.98	.05	.003
Scalar invariance (Model 3)	Model 2 vs. Model 3	51.45	28	.004	.98	.05	.002
Self-evaluation							
Configural invariance (Model 1)		116.34	26	.000	.93	.10	
Metric invariance (Model 2)	Model 1 vs. Model 2	118.85	31	.000	.94	.09	-.002
Scalar invariance (Model 3)	Model 2 vs. Model 3	121.31	36	.000	.94	.08	-.002

Table 13

Subsequent measurement invariance testing on the components 'planning' and 'motivational strategies': Summary of goodness of fit statistics

Measurement invariance tests		YB χ^2	*df*	*p*	CFI	RMSEA	ΔCFI
Planning							
Configural invariance (Model 1)		0.81	4	.938	1.00	.00	
Metric invariance (Model 2)	Model 1 vs. Model 2	2.61	7	.092	1.00	.00	.000
Scalar invariance (Model 3)	Model 2 vs. Model 3	9.00	10	.530	1.00	.00	.000
Motivational strategies							
Configural invariance (Model 1)		6.32	4	.176	.99	.04	
Metric invariance (Model 2)	Model 1 vs. Model 2	6.77	7	.454	1.00	.00	-.009
Scalar invariance (Model 3)	Model 2 vs. Model 3	12.29	10	.266	.99	.03	.009

Reliability analyses

As can be seen in Table 14, the internal consistency of the (sub)scales was acceptable to good, except for 'planning'. As to this scale, CFA however revealed good model fit results.

Table 14

Descriptive statistics and reliability coefficients of the different components

	M	*SD*	$n_{\text{deleted items}}$	n_{items}	Bentler's ρ
Task orientation	3.43	0.76	3	6	.73
Planning	3.34	0.83	6[a]	4	.54
Motivation			5		
External	2.49	1.13		3	.83
Introjected	3.32	0.97		4	.74
Identified	4.34	0.69		4	.79
Intrinsic	3.46	0.96		3	.76
Self-efficacy SRL			6		
Regulation	3.59	0.68		9	.79
Motivation	4.03	0.74		4	.62
Monitoring	3.59	0.72	2	7	.69
Learning strategies			4		
Deep-level	3.59	0.76		9	.84
Surface-level	3.75	0.86		4	.77
Motivational strategies	3.76	0.82	3[a]	4	.65
Persistence	4.18	0.73	1	6	.85
Self-evaluation			4		
Product	3.95	0.91		3	.80
Process	3.23	1.01		4	.77

Note [a]Based on measurement invariance testing two additional items were deleted.

Descriptive statistics and correlations

Table 14 presents the descriptive statistics of the different (sub)scales. The results of full model show a moderate model fit (YB χ^2 = 4853.411, *df* = 2592, *p* < .001, CFI = .87, TLI = .86, RMSEA = .04 with a 90% CI [.03, .034], SRMR = .05). Table 15 shows that the different (sub)scales significantly correlate with each other, except for the subscale 'external regulation', which is not significantly correlated with 'task orientation', 'planning', 'intrinsic motivation', 'self-efficacy regulation', 'self-efficacy motivation', 'persistence', 'surface-level learning strategies', 'monitoring', 'motivational strategies', and 'product evaluation'. As the different (sub)scales 'feed' a complex aggregate pattern of behaviour, it is reasonable to expect that factors will correlate with one another to some degree (Muis et al., 2007).

Table 15

Factor correlation matrix

		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV
I	Task orientation															
II	Planning	.82														
III	External regulation	.06[a]	-.02[a]													
IV	Introjected regulation	.32	.33	.37												
V	Identified regulation	.49	.52	-.12	.33											
VI	Intrinsic motivation	.49	.44	-.00[a]	.33	.60										
VII	Self-efficacy regulation	.70	.67	.05[a]	.33	.65	.64									
VIII	Self-efficacy motivation	.49	.49	-.03[a]	.28	.71	.56	.83								
IX	Deep-level learning strategies	.75	.78	.10	.32	.48	.50	.76	.51							
X	Surface-level learning strategies	.57	.66	-.06[a]	.22	.49	.35	.62	.51	.69						
XI	Motivational strategies	.66	.63	-.03[a]	.35	.55	.51	.61	.70	.63	.52					
XII	Monitoring	.89	.83	.01[a]	.35	.59	.51	.80	.63	.85	.66	.81				
XII	Persistence	.43	.52	-.05[a]	.16	.57	.46	.59	.77	.49	.52	.68	.59			
XIV	Product evaluation	.56	.49	.02[a]	.21	.46	.40	.71	.55	.54	.52	.57	.72	.54		
XV	Process evaluation	.72	.54	.11	.37	.41	.51	.66	.48	.38	.42	.67	.79	.38	.63	

Note. [a] $p > .05$

Discussion

Notwithstanding the shift from self-report inventories toward on-line methods in recent research and the auspiciousness of these on-line methods, there remains a practical need for reliable and valid self-report questionnaires, specifically in the light of large-scale studies and school-based assessment among primary school students. Moreover, in accordance with the view of Butler, Cartier, Schnellert, Gagnon, and Giammarino (2011), it can be argued that self-report tools can be valuable to provide insight into students' awareness about themselves as self-regulated learners and about their use of self-regulatory learning strategies. As such, the key objective of the current research was to develop and (initially) validate a coherent set of scales grasping the multi-component character of SRL, and in this way trying to overcome the shortage of SRL measures comprehensively assessing late primary students' SRL. Grounded in the model of Pintrich (2000, 2004), the broader literature regarding SRL, and developmental research, the Children's Perceived use of Self-Regulated Learning Inventory (CP-SRLI) assesses students' perceptions of SRL regarding nine components. More particularly, SRL was defined as an interaction between cognitive, metacognitive, and motivational aspects. After pilot testing, including reviews by expert and teacher panels as well as cognitive interviews with primary school children, a large-scale item administration was conducted to examine the factor structure using exploratory and confirmatory factor analysis.

Regarding five components (i.e., 'task orientation', 'planning', 'monitoring', 'persistence', and 'motivational strategies'), EFA suggested a one-factor model. With regard to the components 'self-efficacy for self-regulated learning', 'learning strategies' and 'self-evaluation' the analyses showed a two-factor solution. Regarding the 'motivation' component, EFA suggested a four-factor model. The factorial validity was supported by CFA showing moderate to good model fit results corroborating that self-regulatory behaviour and strategies have a multi-component structure (e.g., Boekaerts & Cascallar, 2006). As noted earlier, also factor invariance across gender and gender differences were examined. After removing four items, measurement invariance could be established for all components allowing valid comparison of latent mean scores across gender (Vandenberg & Lance, 2000). Results regarding the gender differences showed, in accordance to previous studies, that boys mostly reported less frequent use of self-regulatory strategies than girls. In this way, the present study adds to the research regarding SRL and gender. Further, for the majority of the (sub)scales the internal consistency was satisfactory.

These results indicate that the set of scales in the CP-SRLI can serve to assess the different components of late primary school children's perceptions regarding SRL. In this respect, the development of the CP-SRLI can be empirically and theoretically significant, as well as relevant for educational practice. First, this instrument focuses on primary school students, whereas previous questionnaires assessing SRL mainly centred on secondary or higher education students. Second, the CP-SRLI can provide researchers the opportunity to investigate the multiple components of SRL simultaneously by using a single instrument comprising multiple scales, instead of relying on different instruments. As such, the CP-SRLI provides a coherent set of measures minimising measurement difficulties when used in conjunction in research. On the other hand, as separate factor analyses on the predefined theoretical components were used, researchers can also opt for selecting a distinct set of CP-SRLI scales consistent with the particular focus of their research. For example, if researchers only want to focus on the cognitive learning strategies of late primary school children, the 'deep-level learning strategies' and 'surface-level learning strategies' subscales can be selected and administrated. In this respect, the CP-SRLI can add to researchers' methodological toolkits by providing a nuanced and diversified portrait of students' perceptions on their engagement in SRL, and more specifically about SRL in academic homework contexts. More particularly, this instrument can be easily administered in groups, which might stimulate large-scale investigation of primary school children's SRL. Moreover, this questionnaire comprises several components allowing teachers and researchers to obtain a differentiated view of children's strengths and weaknesses with respect to their self-regulatory abilities. This information might be helpful to determine the required amount of external regulation and scaffolding for an individual student or a group of students and, in doing so, to determine students' zone of proximal development with respect to SRL (Boekaerts & Cascallar, 2006; Hadwin et al., 2005; Schunk, 2001). This is of particular interest as research indicates that personalised and close guidance is needed to promote SRL (Boekaerts & Cascallar, 2006; Fazey & Fazey, 2001; Winne, 2005). Additionally, it is argued that providing teachers with specific information about their students' SRL might enhance their understanding about the significance of SRL and elicit teachers' engagement to integrate effective SRL-practices supporting students in developing SRL (Askell-Williams et al., 2012; Butler et al., 2011; Whitebread et al., 2009). Descriptive analyses of the CP-SRLI show that students report moderate to relatively high levels of self-regulatory learning strategies. The results however also indicate that there is still room for improvement, especially regarding boys' SRL. These findings corroborate the importance of stimulating SRL during primary education (e.g., De Corte et al., 2011 ; Dignath & Büttner, 2008). Additionally, the CP-SRLI might be a valuable tool to collect data at various measurement points allowing researchers to describe and explore longitudinal changes in self-regulatory learning behaviours and perceptions.

Besides the empirical importance and the relevance for educational practice, the current results confirm the multi-component structure of SRL. Based on theoretical models of SRL, hypotheses about the factor structure of the different components were generated which were largely confirmed. For example, the SDT distinguishes four types of motivation which was supported by the results. On the other hand, the traditional categorization of the learning strategies (i.e., rehearsal strategies, organisational strategies, and elaboration) was not retained. The categorization of deep-level learning strategies and surface-level learning strategies seem to better reflect the cognitive learning strategies of late primary school children. Further, the comprehensiveness of the CP-SRLI can create opportunities to explore the interrelationships among the self-regulatory components on the one hand and the relationships between the components and significant student characteristics on the other hand, leading to further theory development and testing and validation of the instrument. Based on the current results some preliminary correlations between the different aspects of SRL can be deduced (see Table 15).

For example, intrinsic motivation shows high correlation with important self-regulatory strategies, like 'deep-level learning strategies', 'monitoring', and 'process evaluation'.

As the literature points at the importance of a multi-method approach to measure SRL (Boekaerts & Corno, 2005; van Hout-Wolters, 2009; Veenman, 2005) our advice is to supplement the CP-SRLI with on-line methods (e.g., thinking aloud, observations) in future research (e.g., Boekaerts & Corno, 2005; Winne, 2005). Self-report data are a critical view into learners' awareness of how they engage in a task. If these data are triangulated with data of on-line methods (e.g., think-alouds, observations), this can provide a picture of the extent to which learners are actually doing what they report they are doing. This is a valuable starting point to set up interventions and personal guidance. With this kind of multi-method approach (Winne & Perry, 2000), one can profit from the power of different methods to obtain a broader picture and deeper insights into learners' self-regulatory learning strategies (Boekaerts & Corno, 2005; van Hout-Wolters, 2009; Veenman, 2005). As stated by Boekaerts and Cascallar (2006), this approach can also provide insight into how students' attempts at SRL change over time in function of their own perception about SRL.

Although the results of the present study provide support for the initial validity of the CP-SRLI, additional research is needed to further establish the validity of the instrument. First, further investigation of the suggested structure in samples of different cultural contexts is needed. For example, the English version of the instrument (see appendix) could be cross-validated within a predominantly native English-speaking sample. Second, further construct validity evidence should be gathered by exploring the correlation between the CP-SRLI and achievement outcomes (i.e., predictive validity) and by exploring the relation between the CP-SRLI and other measurements assessing late primary school children's SRL (i.e., convergent validity). The latter, however, can be complicated by the shortage of valid self-report questionnaires for this target group. Further, the present instrument can easily be adapted to other contexts or domains than academic homework contexts. This can be achieved by following simple guidelines (see for example Samuelstuen & Braten, 2007). Finally, investigating whether the CP-SRLI would be suitable for use with first-year secondary students will be important in future research, since that would open up new perspectives for longitudinal research. In doing so, students could be followed up with the same instrument when they undergo a significant transition in their educational trajectory, namely from primary to secondary education.

Conclusion

Self-regulated learning is ubiquitous in research on education. The measurement of SRL, however, remains a highly challenging issue, specifically for primary school children. Being aware of the drawbacks, self-report measures like the developed CP-SRLI can, however, be helpful for certain research goals, like large-scale studies and studies aiming at mapping students' perceptions of their self-regulatory strategy use in accordance with the measurement of actual SRL behaviour. Based on a thorough multi-step process, a comprehensive set of scales was developed to assess children's perceived use of self-regulated learning behaviour and strategies. In line with the theoretical framework of Pintrich (2000, 2004), the conceptualisation reflects a multi-component approach to SRL. More particularly, the following components were distinguished: task orientation, planning, motivation, self-efficacy for self-regulated learning, learning strategies, motivational strategies, monitoring, persistence, and self-evaluation. Although further research is required, the present research supports the notion that the CP-SRLI can serve as a valuable measurement to assess, describe, and investigate SRL in late primary school children. In this way, the development of the CP-SRLI is of theoretical and empirical importance, since instruments measuring children's SRL are scarce, especially instruments specifically allowing the simultaneous examination of the multiple components of SRL and permitting large-scale investigations and triangulation with other methods. Furthermore, the instrument is also relevant for educational practice as it encompasses several components allowing teachers to obtain a differentiated view of children's SRL and in this way a tool to diagnose and remediate SRL.

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Appendix

Children's Perceived use of Self-Regulated Learning Inventory (CP-SRLI)

Code[a]	Item[b]
TO1	Before I start my schoolwork, I read the instructions carefully.
TO2	Before I start my schoolwork, I ask myself: 'What is it about? What do I already know about it?'
TO3	Before I start my schoolwork, I ask myself: 'Do I know what kind of a task this is?
TO4	If I get a task similar to one I have already done, I ask myself: 'How did I approach it last time? Was that a good approach?'
TO5	Before I start my schoolwork, I ask myself: 'What do I feel about this task (fun, difficult, interesting, ...)?'
TO6	Before I start my schoolwork, I ask myself: 'Will I succeed?'
PL2	Before I start my schoolwork, I decide what to do first and what later.
PL3	If I find my schoolwork difficult, I allow more time for it.
PL4	If I have to do a large assignment, I start some days before and every day I do a piece of it.
PL5	Before I start my schoolwork, I think how much time I will need.
I do my best for school, ...	
ER1	because I am supposed to do so by others (my parents, the teacher, etc.).
ER2	because others (my parents, the teacher, etc.) oblige me to do so.
ER3	because others (my parents, the teacher, etc.) force me to do so.
INR1	because I would feel guilty if I didn't do my best.
INR2	because I would feel ashamed if I didn't do my best.
INR3	because I want others (my parents, the teacher, etc.) to think I'm smart.
INR4	because I want to show others (my parents, the teacher, etc.) that I am a good student.
IDR1	because I want to learn new things.
IDR2	because I think it is important for the future.
IDR3	because I find it useful for myself.
IDR4	because I find it important to me as a person.
IM1	because I find it very interesting.
IM2	because I like doing it.
IM3	because I enjoy doing it.
I'm good at ...	
SER1	thinking at first about how I will approach my schoolwork.
SER2	planning the timing of my schoolwork before I start making it.
SEM1	motivating myself to start making on my schoolwork.
SEM2	motivating myself to finish my schoolwork.
SEM3	making my schoolwork, even if I find it boring or difficult.
SER3	working with consistent attention during my schoolwork.
SEM4	holding on to my schoolwork.
SER4	knowing what is important and less important when studying.
SER5	pointing out the information that is important when studying.
SER6	Connecting new things to what I already know.
SER7	making a scheme or mind map when studying.
SER8	changing my strategy when it doesn't work out during my schoolwork.
SER9	checking my schoolwork by myself.

When studying, ...	
LSL1	I read or recall everything again and again until I know it by heart.
LSL2	I copy everything until I know it by heart.
LSL3	I cover up part of the material and try to say it out loud.
LSL4	I practise until I know everything.
LDL1	I try to repeat the new material in my own words.
LDL2	I make a summary.
LDL3	I use tricks or mnemonics to remember something easier.
LDL4	I link it to what I already know.
LDL5	I look for examples connected to what I am learning.
LDL6	I make up test questions and answer them after studying.
LDL7	I make a scheme or a mind map.
LDL8	I mark important information or write it down.
LDL9	I look for the main subjects or topics.
LDL10	I figure out the meaning of difficult words.
MOTS1	During my schoolwork, I motivate myself to keep working.
MOTS4	During my schoolwork, I say to myself: 'Just a little more and it is finished!'
MOTS5	During my schoolwork, I say to myself: 'You can do it, just keep on working!'
MOTS6	During my schoolwork, I think about reasons why it is important to complete this schoolwork.
MT1	During my schoolwork, I ask myself: 'Is it working well in this way?
MT2	If I notice something isn't working out, I try a different approach.
MT3	During my schoolwork, I ask myself: 'Do I still understand everything?'
MT4	During my schoolwork, I ask myself: 'Do I still have enough time?
MT5	During my schoolwork, I check what I already have done from time to time and how much I still have to do.
MT6	During my schoolwork, I follow my plan.
MT7	During my schoolwork, I ask myself: 'What part is difficult? What do I have to practice some more?'
P1	Even if I would rather do other things, I make myself start my schoolwork.
P2	Even if my schoolwork is difficult or boring, I do my best.
P3	Even if I would rather do other things, I finish my schoolwork.
P4	I carry on until I finish my schoolwork.
P5	During my schoolwork, I work attentively and don't take my mind off it.
P6	If I am distracted while doing my schoolwork, I immediately try to continue working.
After finishing my schoolwork, ...	
SPROD1	I go over my answers again.
SPROD2	I check that I haven't forgotten anything.
SPROD3	I check if I have done everything that was asked for.
SPROC1	I ask myself: 'Have I done it the right way?'
SPROC2	I ask myself: 'Will I use a similar approach next time, or should I choose a different approach?'
SPROC3	I ask myself: 'Did that way of doing it worked well?'
SPROC4	I ask myself: 'How did I feel about it? (fun, difficult, boring, interesting, ...)?'

Note. [a]TO = task orientation, PL = planning, ER = external regulation, INR = introjected regulation, IDR = identified regulation, IR = intrinsic motivation, SER = self-efficacy regulation, SEM = self-efficacy motivation, LSL = surface-level learning strategies, LDL = deep-level learning strategies, MOTS = motivational strategies, MT = monitoring, P = persistence, SPROD = product evaluation, SPROC = process evaluation.

[b]The items were translated from Dutch into English by the first author. The translation was double checked by the second author, an interpreter and a native-speaker, who is researcher in educational and social research working with primary education pupils.

4 Using think-aloud protocol analysis to gain in-depth insights into late primary school children's self-regulated learning

This chapter is based on:

Vandevelde, S., Van Keer, H., Schellings, G. & van Hout-Wolters, B. (2015). Using think-aloud protocol analysis to gain in-depth insights into upper primary school children's self-regulated learning. Manuscript submitted for publication in *Learning and Individual differences.*

Chapter 4
Using think-aloud protocol analysis to gain in-depth insights into upper primary school children's self-regulated learning

Abstract

Recently, research considering self-regulated learning (SRL) among primary school students has increased since it has been acknowledged that even young students can regulate their learning. However, in-depth and longitudinal information regarding upper primary school children's SRL is still lacking, especially of students at-risk for school failure. Through a longitudinal study eight at-risk students were followed during two successive school years by using think-aloud protocols. At six measurement occasions students were asked to solve a Sudoku and to study an informative text. The results confirm that at-risk upper primary students do engage in self-regulatory strategy use, however on a rather surficial level. Moreover, their strategy use remained rather stable over time. Further, differential results in the Sudoku and text studying task confirm that self-regulatory learning activities can vary across tasks and domains. Regarding the assessment of SRL, the current study illustrates that think-aloud protocols are valuable tools to provide in-depth information concerning late primary school children, while also indicating the need for a multi-method design, especially in order to grasp motivational aspects of SRL.

Introduction

During the past decades, researchers and practitioners have shown great interest in self-regulated learning (SRL), as research has shown that the ability to self-regulate one's learning is essential for academic success (Greene, Robertson, & Croker Costa, 2011; Pintrich, 2004). Although research on SRL was originally dominated by a focus on secondary or higher education (Winne & Perry, 2000), research indicating that also young children are able to regulate their learning processes is growing (Stoeger & Ziegler, 2008; Whitebread et al., 2009; Wigfield, Klauda, & Cambria, 2011). Moreover, current studies underline the importance of effectively promoting SRL already in primary education (Dignath, Buettner, & Langfeldt, 2008; Stoeger & Ziegler, 2011). Therefore, educators need a detailed understanding of self-regulatory learning activities so they can teach them to those who lack these strategies or encounter difficulties with applying them. As such, capturing learners' self-regulatory activities and identifying individual differences therein remains an important focus of the field (Greene et al., 2011; Malmberg, Järvelä, & Kirschner, 2014).

As a response to the growing demand for gaining insights into students' learning, researchers have recognised the value of protocol analysis techniques, such as think-aloud protocols (TAP), as they provide detailed information on how students approach learning tasks (Winne & Perry, 2000). The past decade, there has been a tremendous increase in the use of TAP in studying SRL (Bannert, Reiman, & Sonnenberg, 2014; Veenman, van Hout-Wolters, & Afflerbach, 2006). However, this methodology is often applied with older students and to a lesser extent with primary school children. Moreover, studies investigating and describing SRL of specific groups, such as students with a low socio-economic and immigrant background, and longitudinal data are relatively modest (Zeidner, Boekaerts, & Pintrich, 2000). The present study, therefore, takes a first step in filling this gap in the research literature by following fifth graders with a low socio-economic and/or immigrant background during two successive school years by means of TAP.

Self-regulated learning

SRL has been studied from different perspectives (Dinsmore, Alexander, & Loughlin, 2008; Martin & McLellan, 2008). Although SRL models vary in their specifics, Pintrich (2004) states that SRL generally can be described as "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behaviour, guided and constrained by their goals and the contextual features in the environment" (p. 453). Pintrich (2000, 2004) also provided a conceptual framework detailing various cognitive, metacognitive, and motivational aspects classified within different phases and areas. This framework was adjusted by Vandevelde, Van Keer, and Rosseel (2013) for use with younger target groups, namely late primary school children. This adjusted framework entails nine components: task orientation, planning, motivation, self-efficacy for SRL, monitoring, learning strategies, persistence, motivational strategies, and self-evaluation. These cognitive, metacognitive, and motivational components can be organised in the three general phases of self-regulatory learning processes, namely a forethought and planning phase (task orientation, planning, motivation, self-efficacy beliefs), a performance phase (learning strategies, motivational strategies, persistence, monitoring) and reaction and reflection phase (self-evaluation). These phases are not viewed as hierarchically or linearly structured, but more as dynamic and iterative in which self-reflections from prior efforts to learn can affect subsequent forethought processes (Pintrich, 2000; Zimmerman, 2002).

Task orientation refers to activities in which students analyse the task cues and task demands (Broekkamp & van Hout-Wolters, 2007; Winne, 2001), activate their prior cognitive or metacognitive knowledge (Pintrich, 2004), and express feelings regarding or perceptions of the task (Meijer, Veenman, & van Hout-Wolters, 2006). Based on such a thorough task orientation, students can make a planning by setting concrete learning goals, selecting the most appropriate strategies for achieving these learning goals, and determining how much time and resources will be needed to achieve them (Pintrich, 2000). However, students' willingness to invest in the more demanding self-regulatory learning strategies, will depend on students motives for learning and how competent they feel themselves (i.e., self-efficacy beliefs) to perform a particular task.

After these preparatory activities, students can select and use various cognitive learning strategies, such as rehearsal (e.g., reciting, rereading), organisational (e.g., selecting main ideas, summarising), and elaboration strategies (e.g., paraphrasing, relating new information to prior knowledge) (Weinstein, Jung, & Acee, 2011). Another important characteristic of skilful self-regulated learners is that they actively monitor their strategy use and progress. Furthermore, if they identify deviations from the planned paths they adequately modify their learning behaviour (Moos & Azevedo, 2009a; Pintrich, 2004; Veenman, Elshout, & Meijer, 1997). Beside metacognitive monitoring (e.g., quality control of strategy use or progress) and cognitive monitoring (e.g., comprehension monitoring), students can also monitor their motivation by being aware of one’s own motivational beliefs and affect. If necessary, students can apply motivational strategies, such as positive self-talk or increasing the task value, in order to maintain motivated throughout task performance. Beside the use of motivational strategies, students willingness to delay gratification and to make their environment more conducive for studying, can also help them to persist (Bembenutty, 2009; Corno, 2011).

After task completion (i.e., reflection phase), it is important that students self-evaluate their learning outcomes and processes. Students may also make judgements in terms of affective reactions (i.e., perceived task difficulty, self-efficacy, attributions). These reflections and judgements can inform and influence future behaviour when performing a new learning task (Zimmerman, 2000).

Self-regulated learning of young children

Displaying self-regulatory learning strategies, as described above, cannot be considered as a matter of course. Contemporary research indicates that the development of these strategies in most cases does not occur spontaneously or automatically, but additional training and support is needed to facilitate them (Askell-Williams, Lawson, & Skrzypiec, 2012; Boekaerts, 1997; De Corte, Verschaffel, & Op' t Eynde, 2000; Schneider, 2008; Winne, 2005). So, a particular challenge for self-regulation researchers is to identify at what age these desirable qualities in learning develop and can be enhanced. For a long time, it was believed that young children are unable to self-regulate their learning in any formal way (Schunk, 2001; Zimmerman, 2001) and that the development of important self-regulatory skills, such as metacognitive skills, commence at the age of 8 to 10 (Veenman et al., 2006). It was argued, for example, that children’s egocentrism or their ability to use language covertly were crucial factors limiting self-regulation (Paris & Newman, 1990; Zimmerman, 2001). Further, it was suggested that young children were protected from defensive motivational patterns undermining SRL by their tendency to view ability in incremental terms, be overly optimistic about their ability, and expect that trying hard is sufficient to ensure success (Paris & Newman, 1990; Zimmerman, 1990).

Recent research, however, challenged these assumptions by providing empirical support that young children can and do engage in SRL-activities (Bronson, 2000; Larkin, 2006; Perry et al., 2004; Schneider, 2008; Whitebread et al., 2009; Wigfield et al., 2011). Research by Perry and colleagues (Perry, 1998; Perry & VandeKamp, 2000; Perry, VandeKamp, Mercer, & Nordby, 2002), for example, documented that young children display planning, monitoring, and evaluating behaviour when engaging in complex, multifaceted tasks. Also Whitebread et al. (2009) found that 3- to 5-year-old children performed basic forms of planning, monitoring, and reflection when the task is appropriated to their interest and level of understanding. Similarly, Schneider (2008) states that young primary school children are able to make accurate predictions of tasks' difficulty level (i.e., ease-of-learning judgments) and that this ability, alongside with the ability to judge their performance (i.e., judgments of learning) seems to increase over the primary school years. Further, Cooper and Corpus (2009) found that children's understanding of effective motivational strategies increased throughout primary school. Cognitive learning strategy use seems to shift from lower-level strategies to deeper processing strategies and to an increasing use of multiple strategies (Alexander, Graham, & Harris, 1998; Kron-Sperl, Schneider, & Hasselhorn, 2008). Similarly, Vandevelde, Van Keer, and Merchie (in press) found that fifth and sixth graders display several self-regulatory learning strategies, but on a rather basic level.

As such, these recent findings support the idea that during preschool or early-school years children display elementary forms of SRL and that these strategies become more sophisticated and academically oriented as children proceed through primary school and their further school career (Schneider, 2008; Veenman & Spaans, 2005; Veenman et al., 2006). These findings also imply that students' strategy development and use, and in particular cognitive learning strategies, depend on their experiences and schooling (Alexander, et al., 1998).

Further, it is argued that SRL and fostering SRL becomes increasingly important in transition periods in which students move from a more structured and closely monitored environment, such as primary education, to an environment, such as secondary education, in which they are increasingly confronted with more complex study requirements (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013). To handle these increased expectations, it is expected that students develop a broader and more sophisticated repertoire of self-regulatory learning strategies. However, studies also indicate that students' motivation (Gottfried, Fleming, & Gottfried, 2001; Hornstra, van der Veen, Peetsma, & Volman, 2013) and self-efficacy beliefs decline during primary school and beyond (Spinath & Spinath, 2005; Usher & Pajares, 2008). On their turn, these declines may lead to breakdowns in students' SRL (Cleary & Zimmerman, 2004). Interestingly, very few empirical studies have examined and described students' SRL as they approach the transition towards secondary education.

Children with a low socio-economic and immigrant background

SRL is a complex process influenced by several factors, such as contextual circumstances (e.g., features of the classroom environment, subject domain) and personal characteristics (Pintrich & Zusho, 2007). As to the latter, studies have been investigating SRL among specific groups (e.g., students with learning disabilities) encountering supplementary difficulties in reaching the educational goals (e.g., Bryan, Burstein, & James, 2001; Butler, Elaschuk, & Poole, 2000; Jokic & Whitebread, 2011). However, studies focusing on SRL among children from low socio-economic and/or immigrant background are scarce.

PISA results (OECD 2004, 2013b) repeatedly indicated that students from a low socio-economic and immigrant background show less favourable educational carriers. Unfortunately, this is also the case for Flanders (Belgium) (OECD, 2006, 2013; Park & Sandefur, 2010; Sierens, Van Houtte, Loobuyck, Delrue, & Pelleriaux, 2006). Flemish students from low socio-economic and/or immigrant backgrounds more frequently encounter educational delay at primary and secondary level, are over-represented in technically and vocationally oriented programmes, and drop out school more often. Moreover, these students are underrepresented in higher education (Groenez, Van den Brande, & Nicaise, 2003; Sierens et al., 2006). It can be expected that these students also encounter difficulties in regulating their learning processes. Although few in number, studies show that students from more socio-economically disadvantaged backgrounds generally show less self-regulated learning behaviour (Pappas, Ginsburg, & Jiang, 2003; Ponitz et al., 2008) and have more difficulties engaging in motivated behaviour and investing effort in school towards the end of primary school – a period that is of crucial importance for their future educational career (Hornstra et al., 2013). However, no detailed information is available regarding which specific self-regulatory learning activities these students struggle with.

Think-aloud protocols as method to assess SRL

Although off-line measures, like self-report questionnaires, have their merits within the research field of SRL (Perry & Winne, 2006; Richardson, 2004; Schellings & van Hout-Wolters, 2011), they are less suitable to gather fine-grained and detailed information on self-regulatory learning activities students actually display during a particular learning task (Hadwin, Nesbit, Jamieson-Noel, Code, & Winne, 2007; Veenman, 2011a; Winne & Perry, 2000). In this respect, on-line methods which are obtained concurrent to task performance, are valued as they record what learners actually do, rather than what they recall or believe they do (Winne & Perry, 2000). In research focusing on young children (e.g., preschool and early primary school children), observations are often opted for as on-line assessments as these methods do not rely on children's verbal abilities and can take place in a naturalistic educational setting increasing ecological validity (Alexander, Carr, & Schwanenflugel, 1995; Boekaerts & Corno, 2005; Whitebread et al., 2009; Winne & Perry, 2000). On-line observations, however, can only account for quantitative behavioural assessments of overt behaviour, and not for more covert self-regulatory learning behaviour (Veenman, 2005, 2011b).

Another frequently applied on-line method is the use of think-aloud protocol (TAP). TAP is an example of concurrent verbal reports (Ericsson & Simon, 1980). Collecting TAP typically involves individual assessment in which participants are instructed to verbalize their thoughts, feelings, and cognitive processes while performing a task. Hereby, it is important that the participants are instructed to report verbal (type 1 verbalisations) or nonverbal content (type 2 verbalisations), but are not asked to explain their cognition (type 3 verbalisations) (Ericsson & Simon, 1980). If these conditions are satisfied, a researcher will be able to identify the spontaneous use of self-regulatory learning activities. It is argued that thinking aloud may slightly slow down those processes, but that the concurrent verbalisation of one's thoughts will not interfere with the on-going regulatory processes (Bannert & Mengelkamp, 2008; Ericsson & Simon, 1980; Veenman, 2005; Veenman, Elshout, & Groen, 1993). Compared to observations, TAPs capture not only participants' SRL concurrently with learning, which makes it less vulnerable for memory distortion (Veenman, 2011a), but also allow to asses SRL activities that have a more covert nature and provide more direct and richer access to the internal functioning of students as they complete a particular learning task (Greene et al., 2011; Wolters, Bezon, & Arroyo-Giner, 2011). Further, TAPs allow individual assessment and provide open-ended data allowing participants the freedom to express the full range of their SRL processing (Greene et al., 2011). Given these advantages, TAPs can be considered as a valuable method to provide informative data in terms of how educators can facilitate the knowledge, skills, and abilities underlying effective SRL (Greene et al., 2011). Despite the increased use of TAP within SRL research (Bannert & Mengelkamp, 2008), the use with primary school children is notably rare. In line with Afflerbach and Johnston (1984), Jacobse and Harskamp (2012), and Schellings, Aarnoutse, and van Leeuwe (2006), we believe, however, that TAP is also appropriate to asses late primary school children on the condition that they receive prior training in verbalising their thoughts.

Aim of present study

The abovementioned findings support further attempts to understand students' development of and engagement in SRL. Research providing in-depth information on how students regulate their learning is warranted as a prerequisite for effective SRL promotion (Dinsmore et al., 2008; Schunk, 2008; Winne, 2005), especially among students who experience more challenges with displaying SRL, such as primary school students who are at risk due to their socio-economic or immigrant background. We argue that think-aloud protocols of primary school children can allow us to gather such information and inform further attempts to foster SRL. In this respect, it is our aim to develop a think-aloud protocol. As especially research focusing on particular groups, such as at-risk students, and longitudinal data is lacking, the present study aims to use TAP to map out the development of at-risk fifth graders' self-regulated learning as they approach the important transition towards secondary education. Following research question are addressed: (1) what is the initial state of SRL among students with a low socio-economic and/or immigrant background at the beginning of fifth grade; and (2) how does students' SRL develop as they approach the transition to secondary education.

Method

Participants

The data were collected in the context of a larger-scale quasi-experimental study in which a limited number of students were asked to perform a think-aloud task. The participating students for this study were randomly selected from the control group. In this control group five Flemish (Belgium) inner-city schools with mainly a low socio-economic and ethnic minority population participated. In Flanders, the Department of Education has established criteria in order to define students who are at-risk for school failure (e.g., immigrant background, low maternal educational level, the family lives on social security). Based on these criteria, 85% of the school population were at-risk students due to their low socio-economic and/or immigrant background. From these schools, eight fifth graders (6 boys and 2 girls) were randomly selected with a mean age of 10.43 (*SD* = 0 .38) at first measurement occasion. Table 1 presents more detailed background information on the participants at first measurement occasion. In the participating classes, the teachers were questioned about their actions in promoting SRL by administering the Self-Regulated Learning Inventory for Teachers (SRLIT) (Lombaerts, Engels, & Athanasou, 2007). The SRLIT comprises three subscales representing the cyclical phases of the SRL process: (a) Forethought, (b) Performance control, and (c) Self-reflection. Items were rated on a six-point Likert-type scale ranging from 'never' (0) to 'always' (5). Based on this questionnaire (see Table 1), it can be concluded that the teachers paid rather limited attention to SRL during their daily classroom practice.

Table 1
Participants' background information (at first measurement occasion)

	1	2	3	4	5	6	7	8
Gender	Male	Male	Male	Male	Male	Male	Female	Female
Age	9.97	11.02	10.26	10.19	10.93	10.43	10.07	10.52
Grade retention[a]	No	Yes	No	No	Yes	No	No	No
Different home language	No	Yes	No	No	Yes	No	No	Yes
SRLIT foreth.	4.14	4.14	2.86	2.43	2.14	4.43	2.14	2.86
SRLIT perf.	3.13	3.13	3.75	2.75	3.25	4.63	2.63	2.63
SRLIT self-refl.	3.88	3.88	4.75	2.63	2.75	3.88	1.88	2.88

Note. [a] In case of grade retention, students were 1 year behind compared to their peers.

Design

The participants were followed during two successive school years. In total, data were collected at six measurement occasions, namely at (1) the start of the first trimester of 5th grade (September); (2) end of the first trimester of 5th grade (December); (3) the end of second trimester of 5th grade (March); (4) the start of the first trimester of 6th grade (September), (5) end of the first trimester of 6th grade (December); and (6) the end of second trimester of 6th grade (March).

On-line think aloud protocol analysis

To assess and analyse students' actual and spontaneous use of self-regulatory learning strategies, think-aloud protocol (TAP) analysis was used (Ericsson & Simon, 1980). The participants were asked to individually perform a think-aloud task. The thinking-aloud sessions were audio- and videotaped. Given the younger age of the participants, they received a short (approximately 20 minutes) individual training (Afflerbach & Johnston, 1984; Greene et al., 2011; Schellings et al., 2006; van Someren, Barnard, & Sandberg, 1994). First, the researcher thoroughly explained the underlying purpose and procedure of the task. Second, the researcher modelled thinking aloud during an origami-task. Third, an individual practice phase took place in which students could practice thinking out loud during another origami-task. In both the modelling and practice phase, we opted for a different task than the task involved during the actual thinking aloud task under study to avoid possible training effects (Afflerbach & Johnston, 1984; Greene et al., 2011). During the practice phase, no feedback on students' approach was provided and only in case students fell silent, they were prompted to keep on thinking aloud. In line with the recommendations (van Someren et al., 1994), the training and the entire think aloud procedure was tried out in a pilot session.

Tasks

Given the task-specificity of SRL (Veenman et al., 2006), the participants were instructed to perform two different task representing:(1) solving a Sudoku[1], and (2) studying an informative text in the same way as they do in preparing for a test. More particularly, the following instruction was given: "Your teacher gave me two tasks he/she wants you to complete, namely solving this Sudoku, and studying this text in the same way as you do when you prepare for a test. You also receive a scratch paper which you can use if you want to." The participants were instructed to verbalise their thought processes, actions, and feelings concurrent to task execution. In the case participants fell silent, the researcher prompted the participants by saying 'keep on thinking aloud'. No time constraints or instructions regarding the order in which the

[1] As mathematical tasks are strongly curriculum-dependent, we selected a task which students can execute regardless of the specific curriculum content they already received in class.

tasks should be completed were given. Prior to administration, the comprehensibility and level of difficulty of the tasks was tested within one class, from which no students participated in the study. No adjustments were necessary.

During the Sudoku-task, students had to solve a Sudoku. This task contained a description of the main rules of the game, illustrated by an example of a solved Sudoku. At subsequent measurement occasions, variations on the traditional Sudoku were used to avoid familiarity with the tasks and to ensure the relevance for students to engage in analysing the task instructions (see Table 2). The Sudoku's were of medium difficulty level.

The learning task further comprised of an informative text giving general background information regarding an animal. Before the start of each think aloud procedure, students were asked to write everything down they already know about the animal the study text focuses on. Based on students' responses on this question, it could be deduced that students had little or no prior knowledge. At each measurement occasion, the informative texts consisted of five subtopics: general description, specific physical characteristics, feeding habits, predators and threats of extinction, and reproduction. Headings and subheadings further organised each text and contained several illustrations. All texts were analysed by the Dutch institute for test development (CITO) and were found to be appropriate for this age group and comparable on indexes regarding technical reading level and reading comprehension level[2]. In line with previous studies (Merchie & Van Keer, 2014; Slotte, Lonka, & Lindblom-Ylanne, 2001), students were allowed, but not obligated to use a scratch paper for making notes. Table 2 gives a more detailed overview of the tasks at the different measurement occasions.

Table 2
Task characteristics at different measurement occasions

	Measurement occasion 1	Measurement occasion 2	Measurement occasion 3	Measurement occasion 4	Measurement occasion 5	Measurement occasion 6
Sudoku						
Type of Sudoku	Traditional Sudoku	Puzzle Sudoku	X-Sudoku	Traditional Sudoku	Puzzle Sudoku	X-Sudoku
Amount of empty fields in Sudoku	27	28	29	27	28	29
Average duration	16.13 min. (*SD*=7.97)	13.38 min. (*SD*= 9.05)	10.25 min. (*SD*=5.20)	8.38 min. (*SD*=3.66)	11.13 min. (*SD*=9.78)	9.75 min. (*SD*=3.01)
Text						
Theme	King Penguin	Barn owl	Seahorse	Dragonfly	Otter	Giant panda
Number of words	434	481	482	479	495	496
Average duration	13.38 min. (*SD*= 9.05)	14 min. (*SD*=12.41)	9.63 min. (*SD*= 5.04)	11.13 min. (*SD*=9.78)	11 min. (*SD*=7.56)	14.88 (*SD*=10.79)

[2] In Flanders, the AVI-index (i.e., Analyse Van Individualiseringsvormen [*Analysis of Individualization Forms*]) is used to indicate texts' technical reading level. This index is based on the percentage of high-frequency words and average word length (in letters). As index to indicate reading comprehension and conceptual difficulty levels, the CLIB-index (i.e., Cito LeesIndex voor het Basis- en speciaal onderwijs [*Cito ReadingIndex for elementary and special education*]) is used.

Coding scheme

The development of the coding scheme for analysing the TAPs was both theory- and data-driven. First, the abovementioned theoretical framework served as a blueprint for the development of the coding scheme. Further, in line with Chi (2006), a thorough analysis was executed identifying the range of possible activities the participants could display during the think-aloud task. These activities were categorised according to the nine components (i.e., task orientation, planning, motivation, self-efficacy for self-regulated learning, monitoring, learning strategies, persistence, motivational strategies, and self-evaluation) described in the theoretical framework above. However, regarding two components (i.e., motivation and persistence) no units could be detected. Given the fact that it is difficult to capture students' persistence throughout a task by means of single units, no specific units regarding the component 'persistence' could be found in the data. Similarly, students did not verbalise their motivational reasons to engage in the learning tasks. Although some motivational aspects were incorporated in the coding scheme (e.g., expressions regarding task interest or difficulty), no information regarding students' learning motivation could be detected. In addition to the theoretically included main components, an additional main category was added based on the data, namely adjusting strategy use. In sum, the coding scheme comprises of ten main categories, each further specified by multiple subcategories. At the lowest operational level, specific indicators of self-regulatory activities were formulated. Some of these self-regulatory activities reflected task-specific self-regulatory activities either performed (1) during solving the Sudoku or (2) during text studying. The appendix presents a detailed overview of the (sub)categories in the coding scheme as well as examples from the protocols. Based on current coding scheme, participants' SRL behaviour can be described and analysed in terms of macro-level (i.e., main categories) and micro-level SRL activities (i.e., subcategories and specific indicators) (Greene & Azevedo, 2009). The construction and refinement of the coding scheme was performed on an independent sample of protocols not included in the current study.

Coding strategy

In total, 1,097 minutes of audio- and videotape were collected across six measurement occasions. As the task performance was audio- and videotaped, both verbal and non-verbal behaviour (e.g., highlighting key words, using the scratch paper, gaze direction) was transcribed in order to increase the accuracy of coding (Annevirta & Vauras, 2006; Young, 2005). As unit of analysis, we opted for units of meaning, defined as a unit representing a thematically consisted verbalisation of a single self-regulatory activity (Chi, 1997; van Someren et al., 1994). Each unit of meaning received only one code. When students performed a particular action successively, for example highlighting key words, these actions were not approached as one single segment, but as separate units. In this way, we were able to differentiate between students who only highlighted some keywords from those who used the strategy more extensively. In this respect, 2,379 units of meaning were identified.

Interrater reliability

Two trained coders independently double-coded 375 units (18% of all units), resulting in a high interrater reliability for the main categories (Krippendorff's $\alpha = .98$) and subcategories (Krippendorff's $\alpha = .97$) of the coding scheme (Hayes & Krippendorff, 2007).

Data analysis

As described above, the think-aloud protocols were first coded qualitatively by means of the coding scheme. Based on the think-aloud protocols analyses, individual case reports were conducted which served as the basis for the cross case reports (Yin, 2003). Regarding the first research question, based on the individual case reports, individual strategy repertoires were generated which illustrate the individual students' combination of strategies and their frequency of occurrence in individual students. Further, descriptive analyses were performed on the occurrence of the displayed strategies of all students during the think-aloud tasks (i.e., cross case). As such, the variation between students' strategy repertoires could be examined. Regarding the second research question, non-parametric Friedman's ANOVA was used to analyse the actual occurrence of self-regulatory strategies at the different measurement occasions. Given the small sample, the non-parametric test was opted for and the exact tests were reported (Field, 2009). When a significant evolution was found regarding a particular main category, subsequent tests were performed on the subcategories. Similar to first research question, also a qualitative analysis of the individual strategy repertoires over time was performed by analysing the individual case reports across the measurement occasions. As research stresses the task-specificity of SRL (Veenman et al., 2006), the self-regulatory activities performed during Sudoku and text studying were reported and analysed separately.

Results

Initial state of SRL

Sudoku

Table 3 shows the occurrence of students' use of self-regulated learning strategies during solving the Sudoku. In general, it can be noticed that the occurrence of SRL activities is rather limited. Analyses of the protocols of the first measurement occasion demonstrate a predominant use of monitoring activities (47.65%), followed by adjusting strategy use (24.12%). In contrast, a limited use of task orientation (15.29%), self-evaluation (10.59%), and self-efficacy beliefs (2.35%) is shown. Further, planning activities or the use of motivational strategies were not be observed at all.

Based on the subcategories of the coding scheme a more detailed view arises (see Table 3). Activities regarding task orientation, for instance, mainly reflect detecting task demands (80.7% of all task orientation units). However, in detecting task demands, students merely routinely read the task instructions without processing the demands thoroughly by means of paraphrasing the task instructions for example. Remarkably, students also did not have the habit to reread instructions when encountering problems in solving the Sudoku or when they were hesitating as to approaching the Sudoku in the right way. Also reflecting on task difficulty or task interest (15.38% of task orientation units) or activating prior knowledge (3.85% of task orientation units) rarely occurred. Similarly, students seldom expressed beliefs regarding their competences (2.35%), and when doing so, these beliefs had a negative connotation. Within the types of monitoring activities, students predominantly monitored comprehension (76.54% of monitoring activities) by means of detecting errors (e.g., 'Oh, I already have a three in this row') or indicating difficulties with processing or understanding (e.g., 'It doesn't work out. I already filled in this block and here I have a 7, but in this row I also need a 7'). Other types of monitoring, such as monitoring of progress (e.g., 'Ok, still three rows to fill in.'), deliberate interim checking (e.g., 'I will check this row. 1,2,3,4 …9. That's ok.'), or affective monitoring (e.g., 'It is the first time I solve a Sudoku, and I am actually enjoying it') rarely occurred. Adjusting strategy use mainly reflected correcting mistakes (63.41% of all adaptive strategy use units). Half of the students, tried to control their learning process by navigating purposefully through the Sudoku (e.g., starting with a row with less missing numbers) or asking themselves questions to support the problem solving process (e.g., 'Do I already have a 9 in this row?').

In case students self-evaluated their performance after completion, they almost exclusively evaluated the learning outcome (10 %; e.g., 'Did I fill in all the boxes? Yes, ok, I'm ready.') and hardly ever appraised the learning process (0.59 %; e.g., 'It was sometimes difficult, but now I'm ready.') or expressed affective reactions (0%).

Beside considering the occurrence of SRL activities across all students, we also examined the SRL activities of the individual learners in detail (see Fig. 1). In general, it can be stated that the students execute the different strategies on a rather limited scale and the occurrence of the activities largely varies among students (see Figure 1). Student 8, for example, performed extensively more monitoring and self-evaluation activities compared to the other students. Further, it can be noticed that five students (student 1, 4,6,7,8) displayed strategies across the different SRL-phases. It also appears that the majority of the students combined various strategies. In this regard, it can be noted that all students, except for student 5, combined monitoring behaviour with adjusting their strategies (e.g., correcting mistakes after indicating errors). Finally, Figure 1 also illustrates that some strategies are performed by all or almost all students (e.g., task orientation and monitoring), while other strategies are only performed by a smaller amount of students (e.g., self-efficacy and self-evaluation).

Table 3

Occurrence of students' actual use of self-regulatory learning activities at the first measurement occasion - Sudoku

	Freq.	%	*n*[a]	Max.[b]
Task orientation	26	15.29	8	6
Exploring the task	0	0.00	0	0
Detecting task demands	21	12.35	8	5
Prior knowledge	1	0.59	1	1
Task perceptions	4	2.35	2	3
Planning	0	0.00	0	0
Time management	0	0.00	0	0
Strategic planning	0	0.00	0	0
Self-efficacy	4	2.35	3	2
Motivational strategies	0	0.00	0	0
Positive self-talk	0	0.00	0	0
Making task more interesting	0	0.00	0	0
Increasing task value	0	0.00	0	0
Self-reinforcement	0	0.00	0	0
Monitoring	81	47.65	8	38
Comprehension monitoring	62	36.47	8	25
Monitoring of progress	7	4.12	1	7
Interim checking	8	4.71	3	6
Affective monitoring	4	2.35	3	2
Adaptive strategy use	41	24.12	7	13
Correcting mistakes	26	15.29	7	10
Selective navigation	7	4.12	3	5
Self-questioning	8	4.71	4	3
Self-evaluation	18	10.59	5	14
Learning outcomes	17	10.00	5	13
Learning processes	1	0.59	1	1
Affective reactions	0	0.00	0	0
Total	170	100		

Note. [a] Number of protocols showing a particular activity. [b] Maximum number of occurrence within *one* protocol.

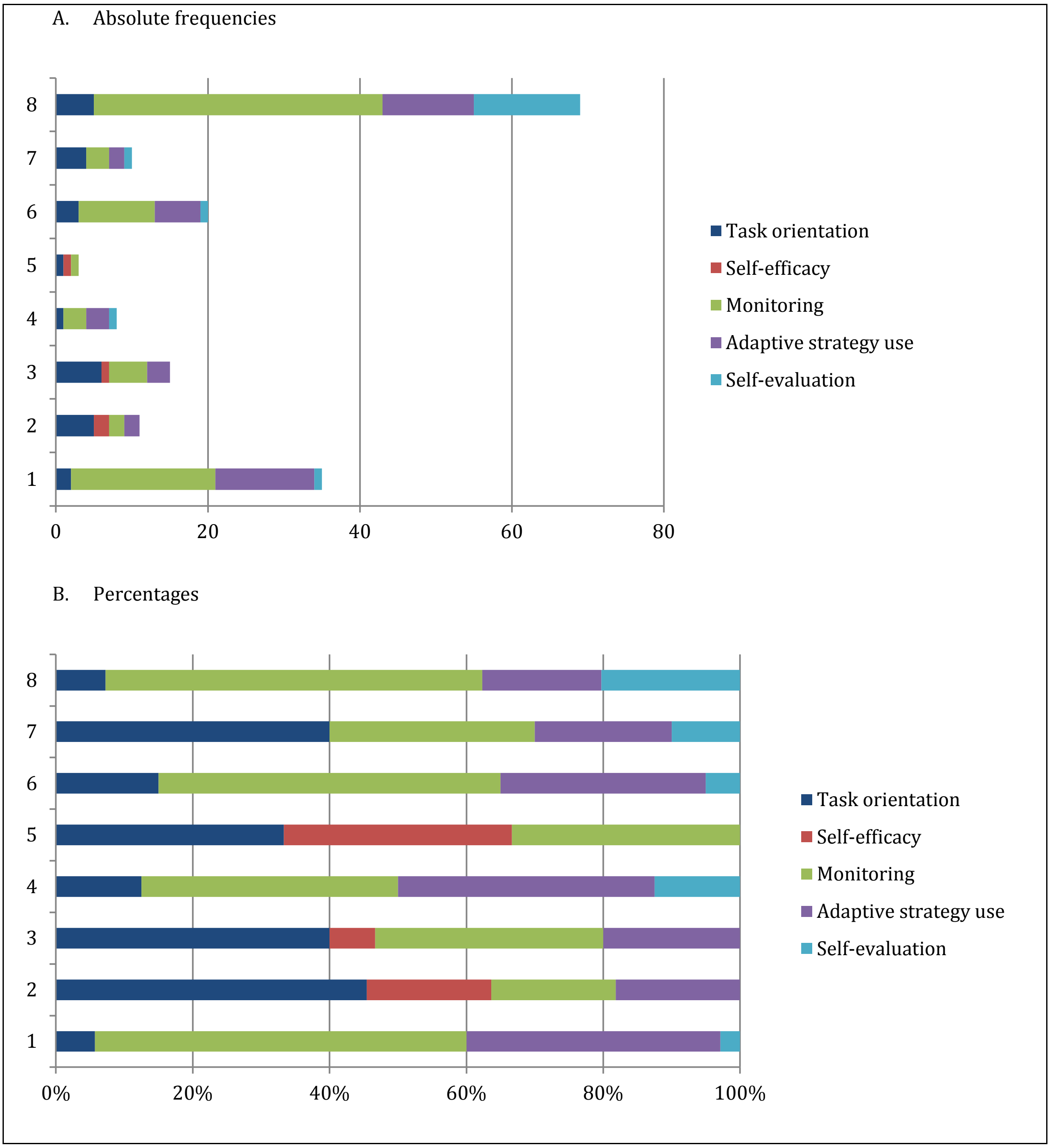


Figure 1. Overview of students' individual strategy repertoire during solving the Sudoku at the first measurement occasion.

Note. No units regarding the following main categories were found: 'planning' and 'motivational strategies'.

Text studying

During text studying, a limited amount of units reflected metacognitive activities (see Table 4). More precisely, 17.4% of the units were coded as monitoring activities, 2.7% as adjusting strategy use, and 0.4% as self-evaluation. No behaviour regarding planning or task orientation could be observed. Monitoring activities mainly concerned interim checking (74.35% of all monitoring units), which was manifested as quick glances at the text during memorising or copying or shortly checking whether they cited the text correctly. However, none of the students inserted a rehearsal moment or self-questioned to check retention. Other monitoring activities, such as expressing confusion or lack of understanding (e.g., 'I don't understand that word.'), reflecting on the progress made (e.g., After writing this sentence, I can start with the last part'), and expressing task interest during performance (e.g., 'This is interesting.') were performed only to a limited extent and by a limited number of students. Adjusting strategy use, such as correcting mistakes during note taking or copying text or self-questioning to improve understanding or learning rarely occurred. Further, only one student (student 4), made a statement regarding his learning outcome (e.g., 'Ok, I know my lesson.'). This statement, however, was not made on the basis of deliberate self-questioning.

As to the cognitive activities, students generally apply rehearsal strategies (62.95%) and to a lesser extent elaboration strategies (16.5%). When applying rehearsal strategies, students memorised the source text by (repeatedly) rereading it (19.86% of all rehearsal strategies units) or more actively by copying and/or reciting it (80.14% of all rehearsal strategies units). Various forms of elaboration strategies were observed (e.g., retelling content in own words, relating content to prior knowledge, linking pictures to text information), with giving personal comments regarding the text content as the most popular (43.24% of all elaboration strategies units). None of the students, however, engaged in organisational strategies, such as highlighting key words or making notes.

In line with the results of the Sudoku, the results of the TAP analysis show a very limited use of motivational activities. As stated above, only expressions regarding task interest (1.79 %) during text studying (i.e., affective monitoring) occurred. Further, no reflections regarding their competence to perform the task or motivational strategies to regulate motivation were observed.

Figure 2 shows the strategy use at the individual student level. In general, it can be stated that the students display a rather limited use of self-regulatory learning activities, and metacognitive strategies in particular. Interestingly, students' strategy use during text studying can predominantly be characterised by activities typical for the performance phase, while preparatory activities (such as task orientation and planning) did not occur and only one student (student 3) evaluated his learning outcome. Regarding the use of cognitive learning strategies, there are substantial differences between the students. This is not only the case regarding the frequency of occurrence of the applied strategies, but also concerning students' approach of the study task. One student (student 5) did not perform subsequent learning activities after his first time reading of the text and only made a statement regarding text comprehension. Five students (student 3, 4, 6, 7, and 8) mainly relied on rehearsal strategies when studying the text, combined with a limited use of elaboration strategies, mainly reflected in personal comments regarding the text content. From these students, student 3 and 4 copied the source text, but only one student (student 4) subsequently recited the source text. The other students (student 6, 7 and 8) reread the text once or twice, accompanied with paraphrasing limited information, linking it to prior knowledge, or providing personal comments. Further, it could be noted that students who show a higher frequency of rehearsal strategies also engage more often in monitoring. This can be due to the fact that the monitoring activities mainly concerned quick glances at the text during memorising or copying. Consequently, students who more frequently applied rehearsal strategies are also the ones who show a higher frequency of monitoring activities. Remarkably, however, monitoring activities were not always followed by adjusting strategy use during text studying. For example, student 1, 2, and 5 expressed confusion or lack of understanding during studying. However, they did not respond adequately to this obstacle, for example, by rereading the text or by consulting a dictionary, but just continued reading.

When comparing the strategy use at both tasks, it can be noticed that metacognitive activities were more often observed during Sudoku. Moreover, compared to the strategy use during the Sudoku task, students combined to a lesser extent various types of strategies during text studying and the different SRL phases were not reflected in their strategy use.

Table 4

Occurrence of students' actual use of self-regulatory learning activities at the first measurement occasion – Text studying

	Freq.	%	n^a	Max.[b]
Task orientation	0	0.00	0	0
Exploring the task	0	0.00	0	0
Detecting task demands	0	0.00	0	0
Prior knowledge	0	0.00	0	0
Task perceptions	0	0.00	0	0
Planning	0	0.00	0	0
Time management	0	0.00	0	0
Strategic planning	0	0.00	0	0
Self-efficacy	0	0.00	0	0
Rehearsal strategies	141	62.95	7	83
Rereading	28	12.50	6	15
Memorising	113	50.45	4	82
Organizational strategies	0	0.00	0	0
Structuring source text	0	0.00	0	0
Making notes	0	0.00	0	0
Elaboration strategies	37	16.52	7	11
Paraphrasing	8	3.57	4	2
Relating to prior knowledge	11	4.91	4	5
Relating text contents	2	0.89	2	1
Providing personal remarks	16	7.14	6	5
Motivational strategies	0	0.00	0	0
Positive self-talk	0	0.00	0	0
Making task more interesting	0	0.00	0	0
Increasing task value	0	0.00	0	0
Self-reinforcement	0	0.00	0	0
Monitoring	39	17.41	6	18
Comprehension monitoring	5	2.23	3	3
Monitoring of progress	1	0.45	1	1
Interim checking	29	12.95	3	18
Affective monitoring	4	1.79	1	4
Adaptive strategy use	6	2.68	2	5
Rereading after confusion	0	0.00	0	0
Correcting mistakes	1	0.45	1	1
Self-questioning	5	2.23	1	5
Self-evaluation	1	0.45	1	1
Learning outcomes	1	0.45	1	1
Learning processes	0	0.00	0	0
Affective reactions	0	0.00	0	0
Total	224	100		

Note. [a] Number of protocols showing a particular activity.

[b] Maximum number of occurrence within *one* protocol.

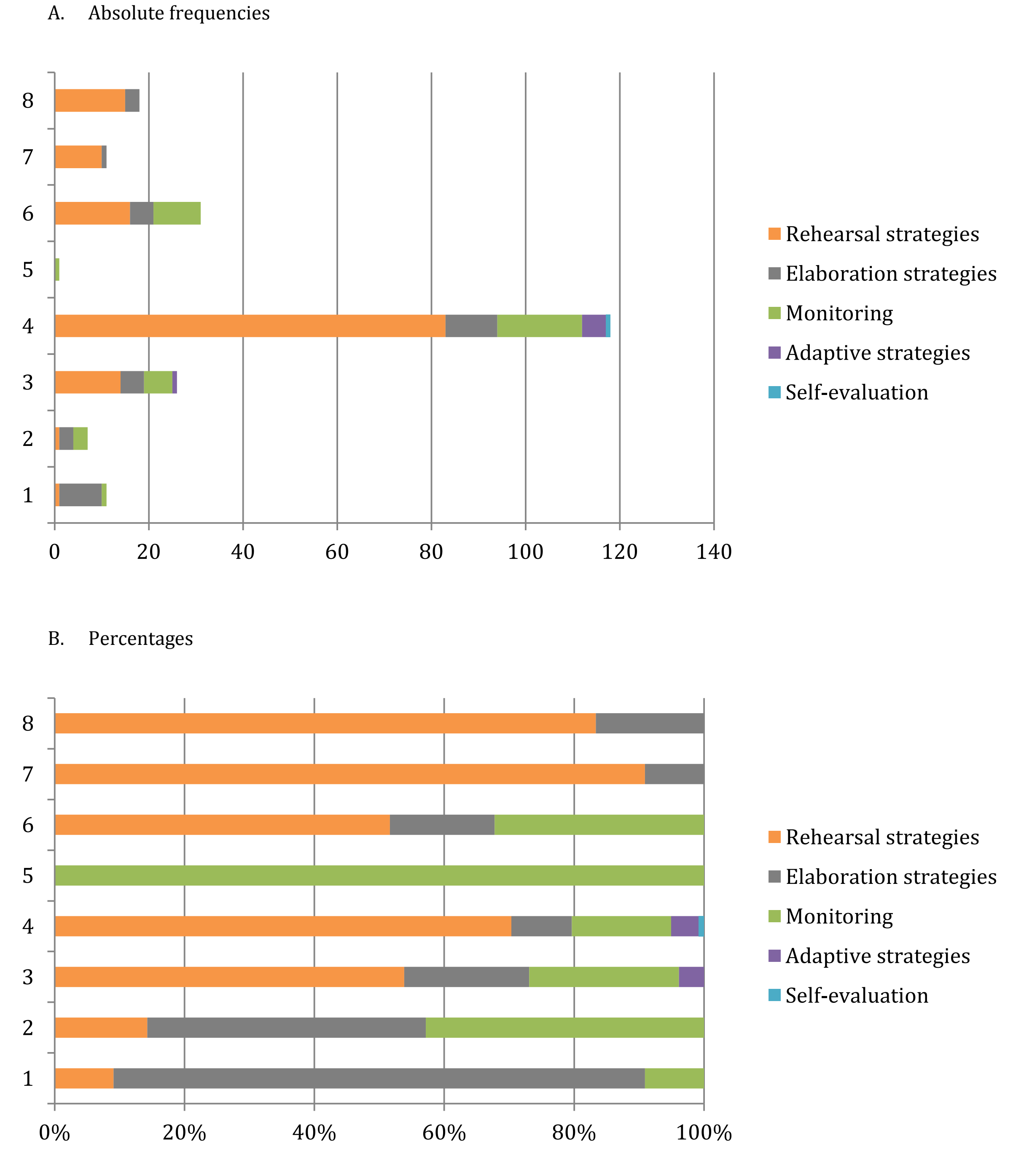


Figure 2. Overview of students' individual strategy repertoire during text studying at the first measurement occasion. *Note.* No units regarding the following main categories were found: 'task orientation', 'self-efficacy', 'planning', 'organisational strategies', and 'motivational strategies'

The development of self-regulatory learning strategies

Sudoku

The results of the Friedman's ANOVA (see Table 5) showed no significant change over the six measurement occasions regarding the occurrence of the main SRL categories: task orientation (χ^2 = 5.91, df = 5, p = .315), self-efficacy (χ^2 = 10.91, df = 5, p = .067), monitoring (χ^2 = 3.49, df = 5, p = .626), adaptive strategy use (χ^2 = 9.51, df = 5, p = .090), and self-evaluation (χ^2 = 9.80, df = 5, p = .062). As 'planning' and 'motivational strategies' were not observed across the measurement occasions, no test statistics are provided regarding these main categories.

Beside this quantitative analysis, we also explored the micro-level SRL activities and strategy use at the individual student level. As shown in Figure 3, students did not report on performing planning activities or using motivational strategies across the different measurement occasions. Task orientation, mostly reflected in reading the instructions, remained rather stable throughout the different test moments. Further, only three students (student 2, 3, and 5) expressed how competent they felt to perform the Sudoku. At the different test moments, student 3 and 5 indicated that they did not feel competent to perform the task and also expressed confusion and misunderstanding during executing the task. However, they did not try to reverse that pattern, by profoundly orientating on the task or by closely monitoring their progress at the subsequent occasion. Student 2, on the other hand, dealt with his uncertainty in a more constructive way during successive measurement occasions by rereading the instructions and by interim checking the task solution. Monitoring activities, mainly characterised by identifying errors, show a decreasing trend. Consequently, adjusting strategy use, primarily reflected in correcting mistakes, also shows a decreasing trend, as both activities are typically performed in conjunction. Further, two peaks regarding monitoring can be distinguished, namely at time 1 and 5. This is, however, mainly due to three students: student 1 and 8 at time1 and student 6 at time 5, who struggled with solving the Sudoku. In student 4 and 6, we also notice a qualitative shift in the use of monitoring activities. At the first measurement occasions they only identified errors. However, during the successive test moments these activities are accompanied with reflection on the progress made and interim checking of correctness. The following excerpts[3] from students' think aloud protocols illustrate this qualitative shift.

> Student 4
> '*Oh, that is wrong, 2 can't be here' […] 'I did something wrong here because 4 is already here.'* (Time 1)
> '*Last row, I'm almost ready.'* (Time 3)
> '*My first column is ready.' […] 'Ok, that column is finished.' […] 'Oh no, this is the first row. Mistake!'* (Time 4)
> *'Ah, here! I have two times a 2.' […] 'Euh, here I have still an empty row.'* (Time 5)

[3] In the original transcriptions also the non-verbal behaviour was transcribed (e.g., pointing at a number in the Sudoku). In the light of reading fluency, these non-verbal gestures were not included in the current examples.

Student 6
'I can fill in 4 here, 1 can be here. Hmm, I don't know it yet'. […] 'Ah, I made a mistake.' (Time 1)
'Oh no, that is not right' […] 'Oh, also an error here.' […] 'Ok, that one is finished.' […] 'I am looking, I want to check whether everything is correct, I still have two empty boxes, so I'm looking whether that 2 is correct.' (Time 5)
'Checking whether I have everything, 1, 2, 3, 4, 5, 6, 7, 8, 9; Ok.' […] 'And now I have finished that row and that block.' […] 'I must look very carefully and attentively.' […] 'No, wait, I made a mistake.'

Finally, self-evaluation rarely occurred across measurement occasions. Two students (student 3 and 5) not ever checked their outcomes or evaluated their approach or process after performance. Only two students (student 4 and 8) consistently verified their outcomes at the end. In the case self-evaluation occurred, students not only looked at whether all the boxes were completed, but mostly checked the correctness of their answers. However, reflection on the process never took place.

Considering the individual trajectories (see Figure 3), the following general findings emerge: six students approached the tasks in a similar way across the six measurement occasions. One of these students, however, performed the SRL strategies less frequently at the later occasions. Only two students (student 4 and 6) show subtle changes in the variety of monitoring strategies, as stated above.

Table 5

Results of Friedman's ANOVA – Sudoku

	Time 1 *Median (Range)*	Time 2 *Median (Range)*	Time 3 *Median (Range)*	Time 4 *Median (Range)*	Time 5 *Median (Range)*	Time 6 *Median (Range)*
Task orientation	3.50 (5)	2.50 (13)	2 (7)	2 (6)	1.50 (4)	3 (2)
Exploring the task	0 (0)	0 (1)	0 (0)	0 (3)	1 (2)	0 (1)
Detecting task demands	2.50 (4)	2 (14)	1 (5)	2 (3)	1 (4)	2 (2)
Activation prior knowledge	0 (1)	0.50 (1)	0.50 (2)	0 (1)	0 (1)	0 (2)
Task perceptions	0 (3)	0 (1)	0 (1)	0 (1)	0 (0)	1 (1)
Planning	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Time management	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Strategic planning	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Self-efficacy	0 (2)	0 (0)	0 (0)	0 (1)	0 (1)	0 (0)
Monitoring	4 (37)	4 (15)	2 (12)	3 (8)	3.50 (33)	4 (8)
Comprehension monitoring	3 (24)	3 (6)	2 (9)	1 (5)	2 (11)	1.50 (6)
Monitoring of progress	0 (7)	0.50 (4)	0 (3)	1 (5)	0 (6)	2 (4)
Interim checking	0 (6)	0 (6)	0 (4)	0 (2)	1 (16)	0 (2)
Affective monitoring	0 (2)	0 (1)	0 (3)	0 (3)	0 (3)	0 (2)
Motivational strategies	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Positive self-talk	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Making task more interesting	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Increasing task value	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Self-reinforcement	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Adaptive strategy use	3 (13)	4 (10)	3.50 (11)	0 (4)	2 (7)	2 (5)
Correcting mistakes	1.50 (10)	1 (3)	0.50 (6)	0 (2)	1.50 (4)	1 (5)
Selective navigation	0 (5)	0.50 (6)	0 (12)	0 (4)	0 (3)	0 (4)
Self-questioning	0.50 (3)	0 (8)	0 (8)	0 (0)	0 (1)	0 (1)
Self-evaluation	1 (14)	1 (3)	0 (1)	0 (4)	0.50 (3)	0 (1)
Learning outcomes	1 (13)	1 (3)	0 (1)	0 (3)	0.50 (3)	0 (1)
Learning processes	0 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Affective reactions	0 (0)	0 (1)	0 (0)	0 (1)	0 (0)	0 (0)

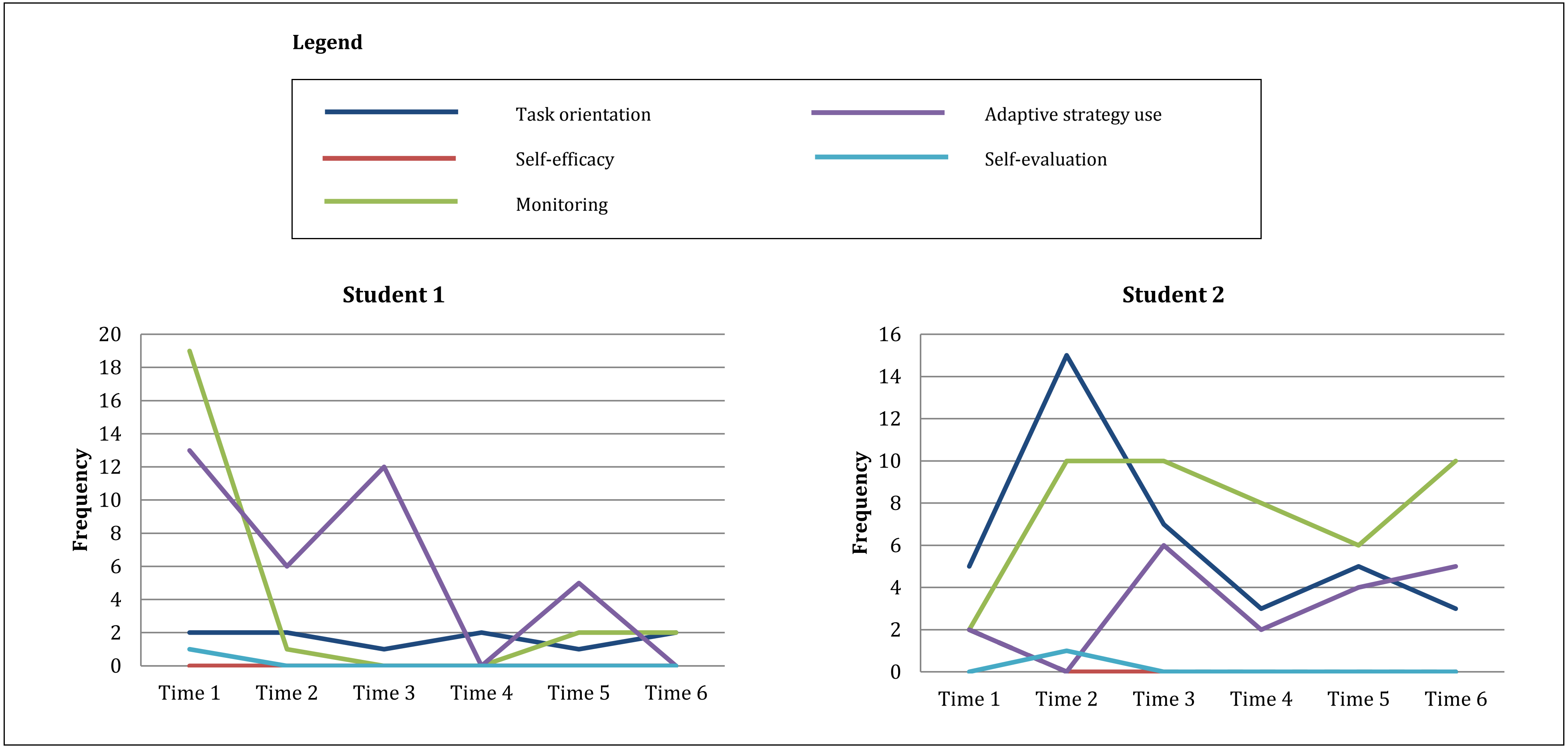


Figure 3. Individual and overall patterns of changes – Sudoku.
Note. Across measurement occasions and participants, no units regarding following main categories were found: 'planning' and 'motivational strategies'

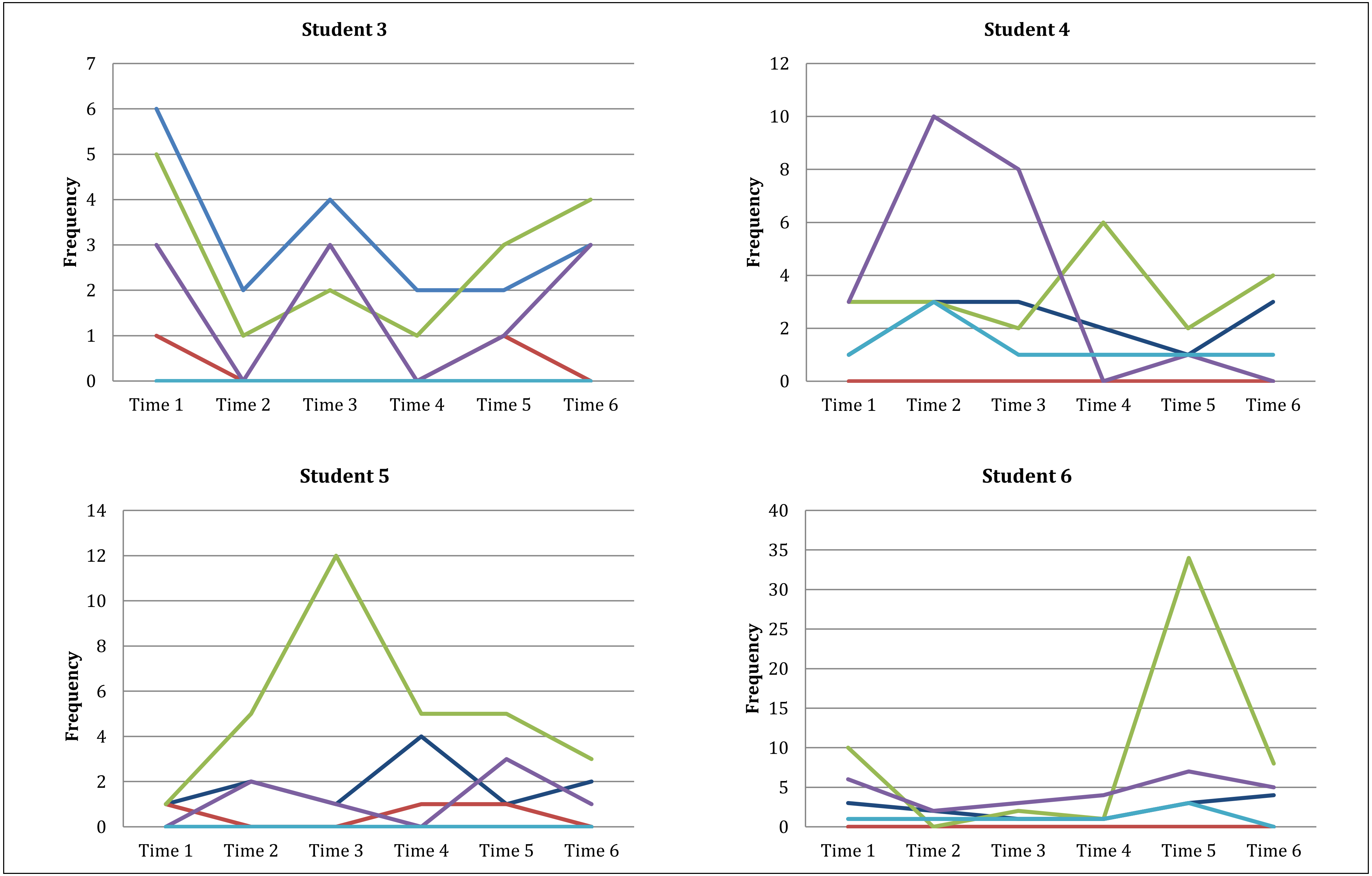


Figure 3. Individual and overall patterns of changes – Sudoku (continued).
Note. Across measurement occasions and participants, no units regarding following main categories were found: 'planning' and 'motivational strategies'

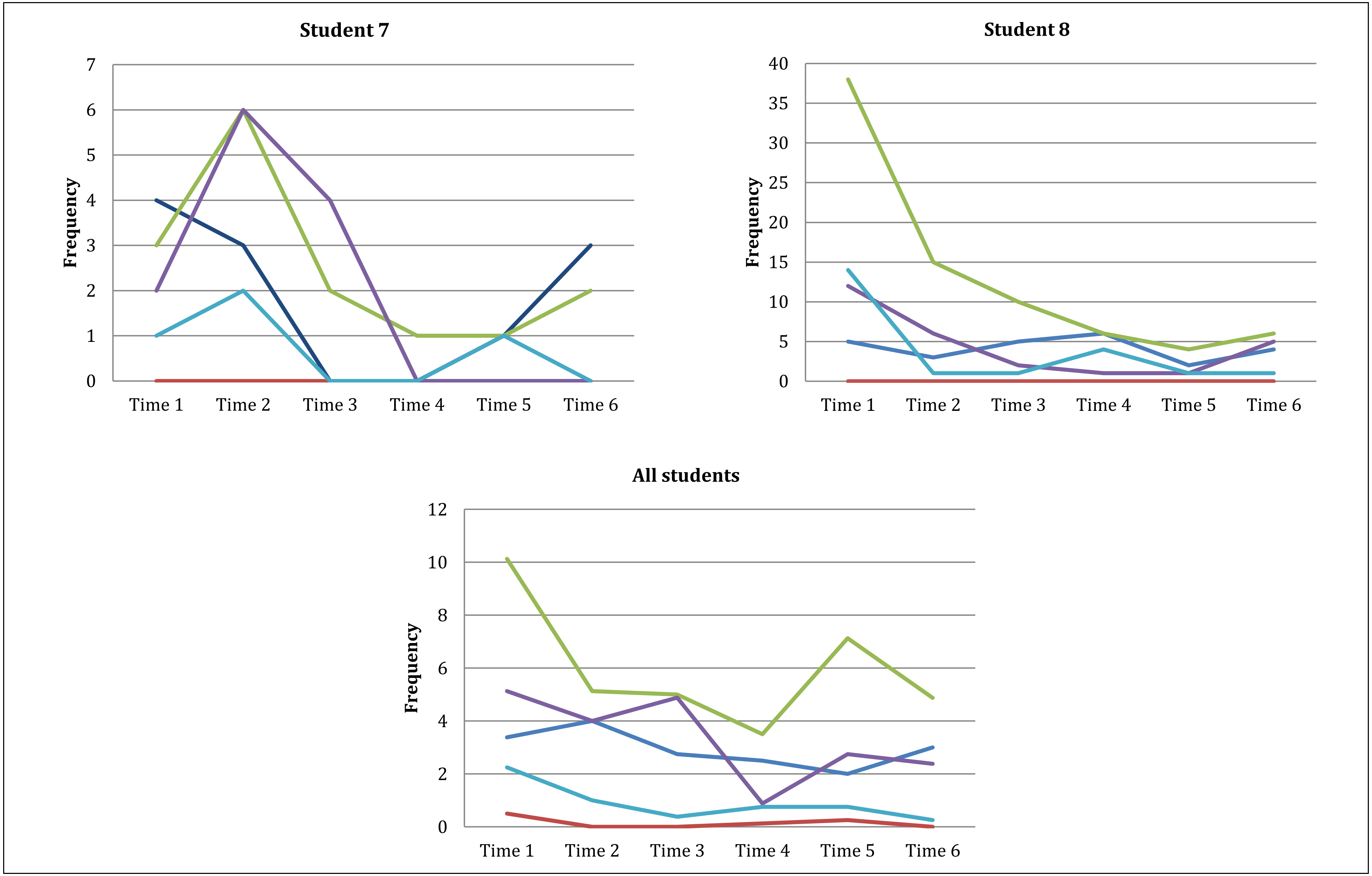


Figure 3. Individual and overall patterns of changes – Sudoku (continued).
Note. Across measurement occasions and participants, no units regarding following main categories were found: 'planning' and 'motivational strategies'

Text studying

Considering the metacognitive categories during text studying, no significant differences were found regarding the occurrence of the main SRL categories at the different measurement occasions (see Table 6): task orientation (χ^2 = 5.70, *df* = 5, *p* = .353), planning (χ^2 = 7.17, *df* = 5, *p* = .278), monitoring (χ^2 = 5.82, *df* = 5, *p* = .324), adaptive strategy use (χ^2 = 5.33, *df* = 5, *p* = .412), and self-evaluation (χ^2 = 4.26, *df* = 5, *p* = .533).

Further qualitative analyses confirm the rather stable use of metacognitive strategies over time as there were no remarkable changes detected (see Figure 4). Across the different test moments, students occasionally executed orientation on the task, planning behaviour, or self-evaluation and applied these activities on a basic level. For instance, in the rare case students planned their task beforehand, they did not made a time schedule and only two students (student 4 and 6) occasionally reflected on how they would approach the task by describing the different steps they would undertake to perform the task (e.g.,' I will first read the text, then underline the key words and try to recite the text.'). More profound forms of strategic planning, such as selecting the most appropriate strategy given the learning objectives after considering various possible approaches, was not observed. Slightly more, but still few units addressed monitoring activities. These actions were, however, mainly restricted to interim checking during copying or reciting the text. Students also irregularly evaluated their learning outcome, mostly by statements such as: 'Let's have a look, did I study everything?' and by correspondingly scanning the text quickly. During none of the measurement occasions students reflected on their learning strategy use and only two students (student 3 and 8) made once a reflection regarding their task interest after completing the task (e.g., 'It was exciting to read. I enjoyed it').

With regard to students' use of cognitive learning strategies during text studying, only a significant difference was found with respect to the main category 'organisational strategies' (χ^2 = 13.40, *df* = 5, *p* = .011). Further analyses show that this change is only due to the increasing use of the subcategory 'making notes' (χ^2 = 17.48, *df* = 5, *p* = .011). Regarding the other learning strategies, namely rehearsal strategies (χ^2 = 5.47, *df* = 5, *p* = .361) and elaboration strategies (χ^2 = 6.44, *df* = 5, *p* = .265), no significant changes over time were found.

Qualitative analyses confirmed the increase of 'making notes' across measurement occasions. At the final measurement occasion, five students (2, 4, 5, 6, 8) – as compared to none of the students at the first measurement occasion - made notes. Four of them noted down key words or key sentences and one student made a linear summary (student 4). In exploring the summary (see Figure 5), it appears that the student found it difficult to make a well-organized and structured summary, as little text restatements or reorganization could be detected. Figure 5 also illustrates the difficulty students encounter in selecting main ideas from side ideas which is reflected in the high amount of highlighted key words or even full sentences. Moreover, in structuring the text, none of the students used structural cues or different colour codes to visualise hierarchical structure in the text. Remarkably, not all note making was combined with structuring the source text. Only two of the five students (student 4 and 6) combined these two organisational strategies. Further, across the different measurement occasions, none of the units were coded as ‘expressing self-efficacy beliefs’ or ‘motivational strategies’. Only in an exceptional case, students expressed their interest in the task during text studying (i.e., affective monitoring).

Looking more in detail at the individual changes, some patterns can be seen regarding cognitive strategy use in particular (see Figure 4). As such, three students (student 1, 3 and 7) approached the task similarly at the different test moments and showed rather limited and one-sided use of the learning strategies. Also student 6 generally relied on the same repertoire across the test moments. However, based on a more profound qualitative analysis, it can be seen that this student integrated the strategies more efficiently throughout the study. At the second measurement moment, for example, he highlighted key words, but when memorising the text, he literally recited the source text. At the last measurement moment, he also highlighted key words, but during memorising he focused on these highlights instead off on the source text. Further, four students (student 2, 4, 5, and 8) expanded their repertoire of cognitive learning strategies over time by supplementing rehearsal and elaboration strategies with highlighting key words and making notes. At this point, however, the notes were not yet used as a synoptic tool for further learning. When memorising the content afterwards, they primarily returned to the source text and in some occasions they focused on the highlighted sentences or words.

Generally, when comparing the development of strategy use during both tasks, the results show that the strategy use during solving the Sudoku remained rather stable, with a slightly decreasing trend regarding monitoring and adaptive strategy use. However, some qualitative improvements regarding monitoring could be observed. Regarding the metacognitive strategies during text studying no clear change over time was shown. The use of cognitive learning strategies displayed, however, a more unstable pattern across measurement occasions. Further, it should be noticed that students who showed some qualitative improvement in their regulatory behaviour during the Sudoku-task (student 2, 4, and 6) also refined their approach of the text studying task.

Table 6

Results of Friedman's ANOVA – Text studying

	Time 1 *Median (Range)*	Time 2 *Median (Range)*	Time 3 *Median (Range)*	Time 4 *Median (Range)*	Time 5 *Median (Range)*	Time 6 *Median (Range)*
Task orientation	0 (0)	0 (1)	0 (1)	0 (3)	0 (1)	0 (1)
Exploring the task	0 (0)	0 (1)	0 (0)	0 (2)	0 (1)	0 (1)
Detecting task demands	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Activation prior knowledge	0 (0)	0 (0)	0 (1)	0 (1)	0 (0)	0 (0)
Task perceptions	0 (0)	0 (0)	0 (1)	0 (0)	0 (0)	0 (1)
Planning	0 (0)	0 (2)	0 (1)	0 (2)	0 (1)	0 (1)
Time management	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Strategic planning	0 (0)	0 (2)	0 (1)	0 (2)	0 (1)	0 (1)
Self-efficacy	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rehearsal strategies	12 (83)	2 (107)	2.50 (31)	0.50 (64)	1.50 (40)	0 (41)
(Re)reading	1 (15)	0.50 (5)	0 (4)	0 (2)	1 (2)	0 (3)
Memorising	1 (82)	0 (106)	0 (30)	0 (62)	0 (39)	0 (38)
Organisational strategies	0 (0)	0 (75)	0 (20)	0 (61)	10.50 (64)	7 (100)
Structuring source text	0 (0)	0 (75)	0 (6)	0 (0.51)	5.50 (51)	0 (43)
Making notes	0 (0)	0 (0)	0 (19)	0 (32)	0 (30)	6 (57)
Elaboration strategies	4 (11)	5 (22)	6 (22)	0 (15)	1.50 (13)	1 (7)
Paraphrasing	1 (2)	0.50 (22)	0.50 (17)	0 (3)	0 (6)	0.50 (5)
Relating to prior knowledge	0.50 (5)	0 (2)	0 (3)	0 (7)	0.50 (2)	0 (2)
Relating text contents	0 (1)	0 (1)	0 (0)	0 (1)	0 (0)	0 (0)
Providing personal remarks	2 (5)	0 (9)	3 (12)	0 (5)	0 (6)	0 (4)
Motivational strategies	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Positive self-talk	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Making task more interesting	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Increasing task value	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Self-reinforcement	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Monitoring	2 (18)	0.50 (10)	0 (26)	0 (22)	2 (20)	0.50 (34)
Comprehension monitoring	0 (3)	0 (1)	0 (2)	0 (0)	0 (0)	0 (0)
Monitoring of progress	0 (1)	0 (8)	0 (0)	0 (2)	1.50 (3)	0 (4)
Interim checking	0 (18)	0 (1)	0 (24)	0 (22)	0.50 (18)	0 (32)
Affective monitoring	0 (4)	0 (1)	0 (1)	0 (1)	0 (1)	0 (0)
Adaptive strategy use	0 (5)	0 (1)	0 (1)	0 (0)	0 (1)	0 (0)
Rereading after confusion	0 (0)	0 (0)	0 (1)	0 (0)	0 (0)	0 (0)
Correcting mistakes	0 (1)	0 (0)	0 (0)	0 (0)	0 (1)	0 (0)
Self-questioning	0 (5)	0 (1)	0 (1)	0 (0)	0 (0)	0 (0)
Self-evaluation	0 (1)	0 (1)	0.50 (1)	0.50 (2)	0 (2)	0 (2)
Learning outcomes	0 (1)	0 (0)	0.50 (1)	0.50 (2)	0 (2)	0 (2)
Learning processes	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Affective reactions	0 (0)	0 (1)	0 (0)	0 (0)	0 (0)	0 (0)

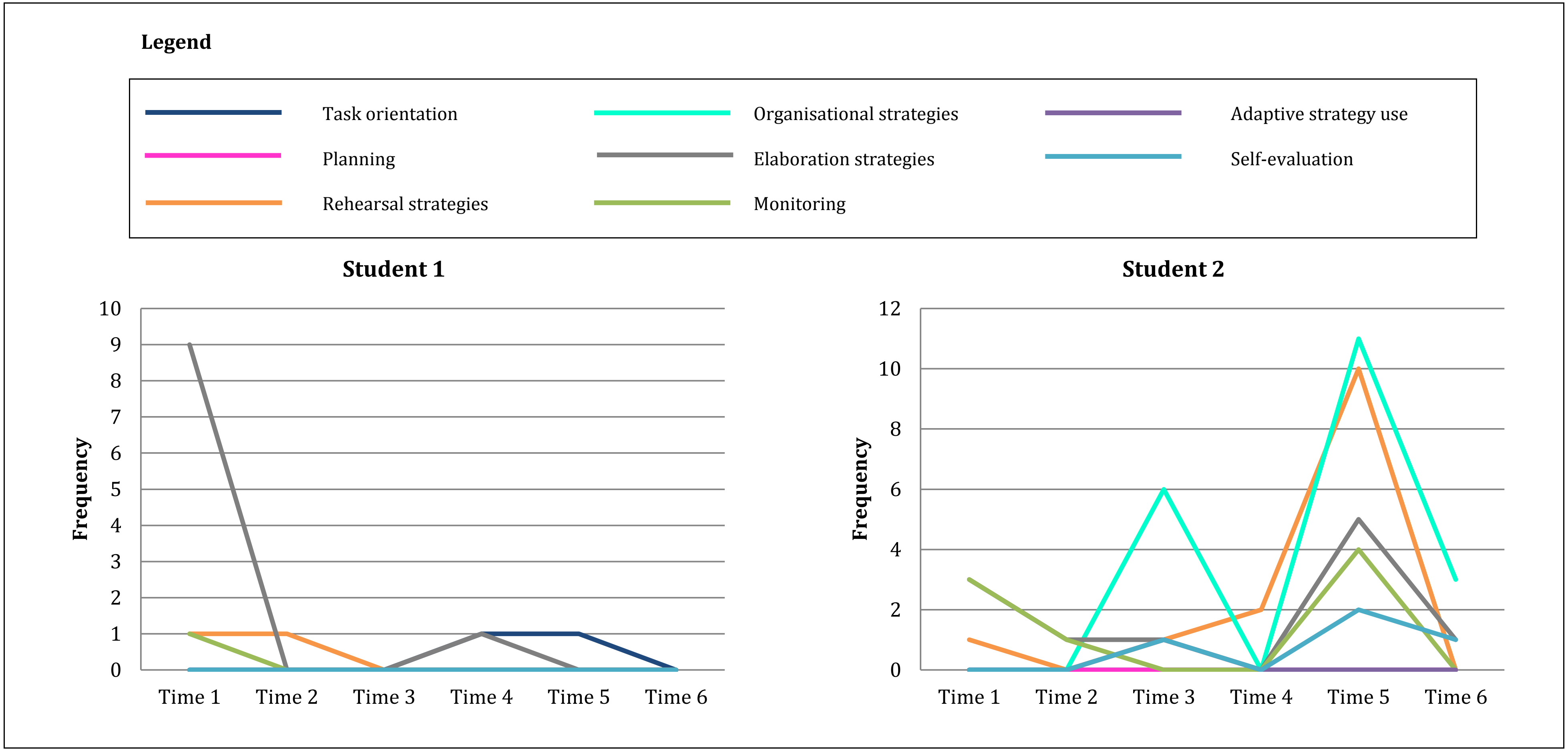


Figure 4. Individual and overall patterns of changes – Text studying.

Note. Across measurement occasions and participants, no units regarding following main categories were found: 'self-efficacy' and 'motivational strategies.

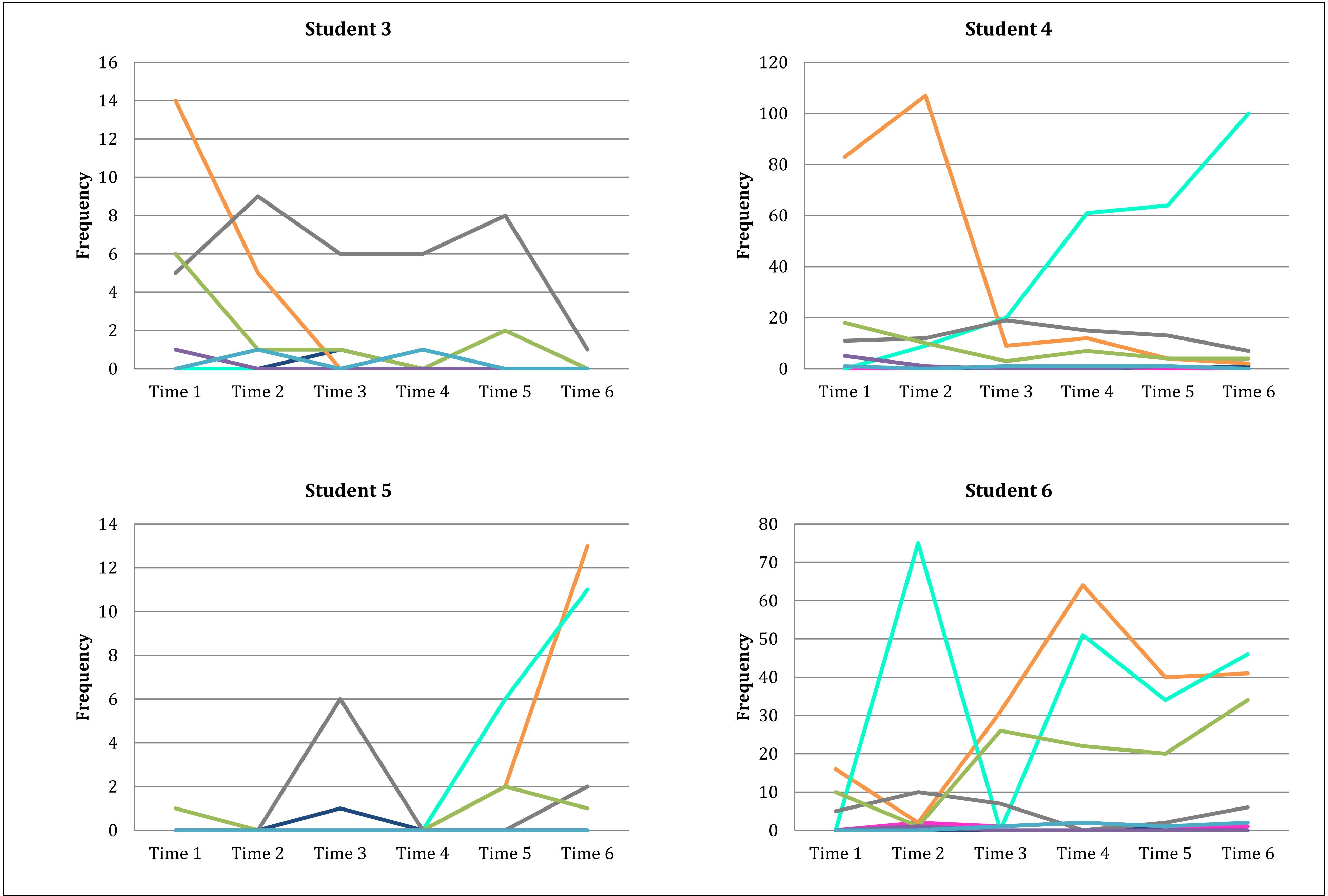


Figure 4. Individual and overall patterns of changes – Text studying (continued).

Note. Across measurement occasions and participants, no units regarding following main categories were found: 'self-efficacy' and 'motivational strategies.

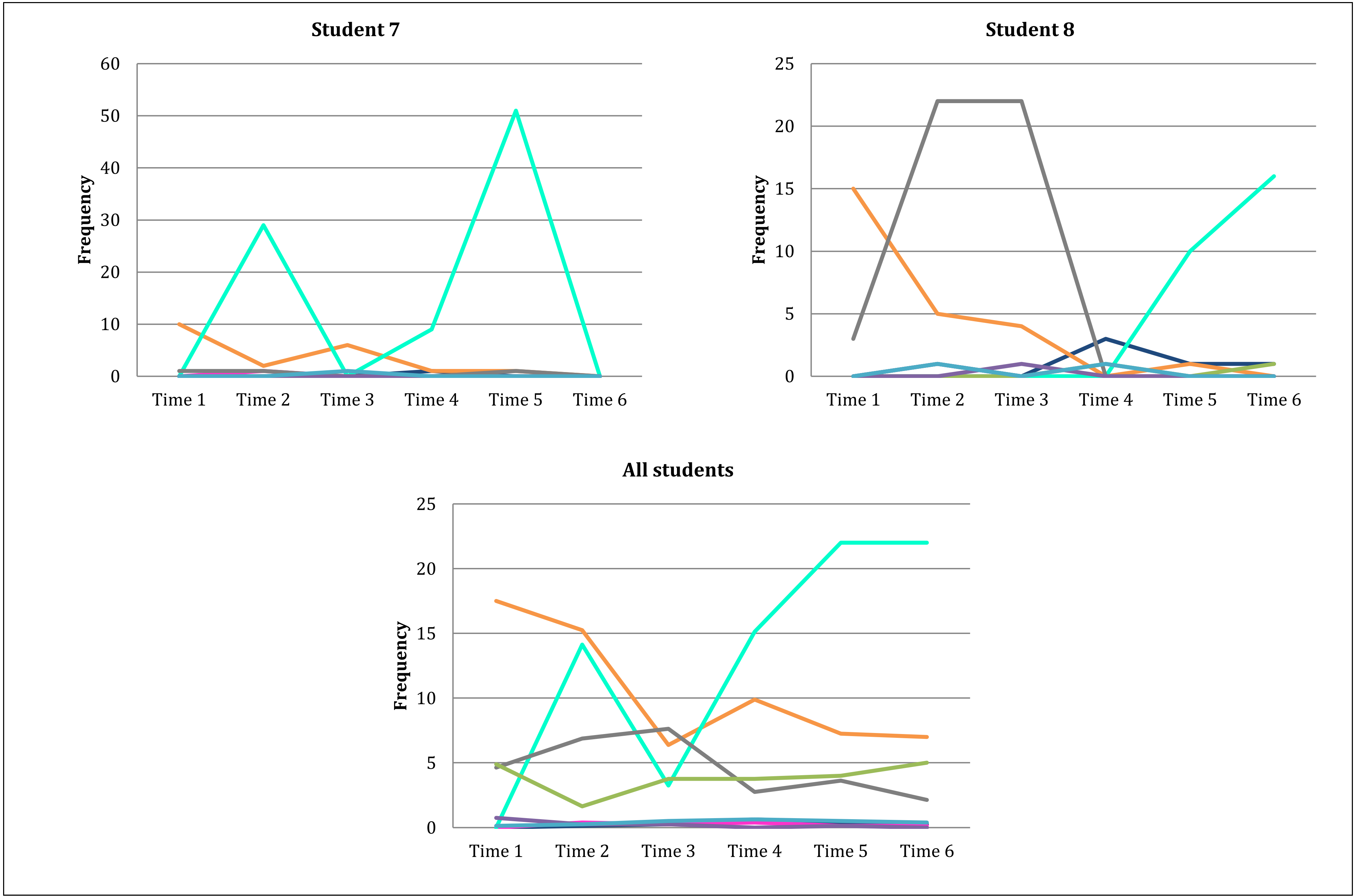


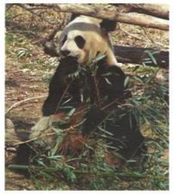
Figure 4. Individual and overall patterns of changes – Text studying (continued).

Note. Across measurement occasions and participants, no units regarding following main categories were found: 'self-efficacy' and 'motivational strategies.

De wondere wereld van de panda

Wat is een panda? Waarom zijn ze zo speciaal?

Met zijn zwarte en witte vlekken ziet de reuzenpanda er schattig uit, als een knuffeldier. Maar reuzenpanda's zijn familie van de beren. Een volwassen reuzenpanda is 80 tot 150 cm lang en weegt ongeveer 100 kg. Er zouden maar 1600 reuzenpanda's meer in het wild leven. Ze zijn dus erg zeldzaam en bedreigd. Je vindt ze enkel in berggebieden in het zuidwesten van China want daar zijn veel bamboebossen.



Wat eten ze?

Panda's eten vooral bamboe. Bamboe is een grassoort die zo hoog als bomen kan worden. Bamboe is niet zo voedzaam en daarom moet de panda er heel veel van eten. Zo kan hij wel 20 kg bamboe per dag verorberen. Hij is dan ook de hele dag bezig met het zoeken en eten van voedsel. Tijdens het eten zit de panda op de grond zodat hij zijn voorpoten kan gebruiken de bamboe vast te houden.

Wie zijn hun vijanden?

Meestal heeft de panda geen last van andere dieren omdat ze bang van hem zijn. Als er toch gevaar dreigt van roofdieren, zoals luipaarden en jakhalzen, klimt hij in een boom. Maar jammer genoeg vormen mensen een grote bedreiging voor panda's. Zij vernielen bamboebossen om er bijvoorbeeld huizen te bouwen. Vroeger werden er ook veel panda's gedood door jagers. Nu worden de panda's en de gebieden waar ze leven beschermd.

Hoe komt een kleine panda op de wereld?

Panda's leven vooral in hun eentje. Alleen in de lente zoeken mannetjes en vrouwtjes elkaar op om te paren. Na 5 maanden wordt het pandajong geboren. Er is meestal maar één jong. Bij de geboorte is hun vacht nog wit, na enkele weken krijgen de jongen de zwarte vlekken. Pasgeboren jongen wegen slechts 85-150 gram. Ze zijn 900 keer kleiner dan hun moeder! Maar door de moedermelk, groeien ze heel snel. Na 1 jaar wegen ze al 25 kg! Een panda drinkt nog melk tot hij ongeveer 9 maand oud is. Maar vanaf 5 of 6 maanden, begint hij ook al bamboe te eten. De jonge panda blijft ongeveer 18 maanden bij zijn moeder, daarna gaat hij zijn eigen weg. Op vijf- of zesjarige leeftijd zijn panda's volwassen en kunnen de vrouwtjes zelf jongen krijgen.

reuzepanda is 80 tot 150cm lang en weegt ongeveer 100 kg reuzepanda's zijn familie van de beren
~~volwassen reuzenpand~~ 1600 reuzepanda's in het wild leven zeldzaam en bedreigt
oren voor en achterpoten en rond de ogen eet geen vlees, toch vleeseter gebit: scherpe hoektanden
platte kiezen om planten stuk te bijten. Elke voorpoot een zesde vinger gebruikt als duim meestal op hun 4 poten
door hun scherpe klauwen kunnen ze goed in bomen klimmen. korte staart borstel geursporen verspreiden op bomen
bakenen ze hun territorium af. Bamboe. bamboe is niet zo voedzaam en daarom moet de panda er veel
van eten 20 kg bamboe per dag verorberen hele dag bezig met het zoeken en eten van voedsel tijdens zit
op de grond voorpoten kan gebruiken om de bamboe vast te houden. geen last van ander dieren
toch gevaar dreigt van roofdieren zoals luipaarden en jakhalzen klimt hij in een boom
mensen een grote bedreiging voor panda's vernielen bamboe bossen vroeger veel panda's gedood door
jagers gebieden waar ze leven beschermd. leven vooral in hun eentje lente zoeken elkaar op
om te paren 5 maanden pandajong geboren meestal 1 jong vacht nog wit enkele weken krijgen
de jong zwarte vlekken wegen slechts 85-150 gr 900 keer klein dan hun moeder.
moedermelk groeien snel 1 jaar 25 kg drinkt nog melk 9 maand oud is 5 of 6 maand begin bamboe
eten 18 maanden bij zijn moeder 5 of 6jarige leeftijd volwassen vrouwtjes zelf jongen krijgen

Figure 5. Traces of structuring in the source text and making notes (student 4).

Discussion

Researchers and educational practitioners emphasise the significance of SRL for successful learning in and beyond school, but they simultaneously acknowledge the complexity and difficulty in acquiring these skills for primary school students. In order to advance understanding of SRL and to inform educational practices promoting SRL, empirical evidence documenting the difficulties that students face is wanted. This is especially the case for students who have higher risk for school failure or drop out, such as students with a low socio-economic and/or immigrant background. Moreover, it seems important to empower these students from an early age on instead of waiting until secondary or higher education when attitudes and habitual actions associated with academically ineffective behaviours are already formed. Therefore, this study aims to gain in-depth insight into late primary school students' learning and to uncover the details of how their learning activities unfold during different types of tasks and over time. More specifically, 8 fifth graders were followed during two successive school years by using TAP. Given this aim, a think-aloud protocol was developed. In the following paragraphs, we discuss late primary school children's spontaneous use and development of SRL, as well as the value of TAP as a method to assess these strategies in this age group.

Initial state of SRL

The descriptive results fit in with recent evidence that young children are capable of performing self-regulated behaviour (e.g., Perry, Phillips, & Dowler, 2004; Whitebread et al., 2009). In-depth analysis of the think-aloud protocols indicate, however, that the strategies were performed on a rather limited basis and on a rather superficial level, not yet sophisticated or academically oriented, and largely varying across students.

As elaborated on in next paragraph, motivational activities were rarely elicited during thinking aloud. Students only occasionally express task perception or competence beliefs, but no motivational strategies were referred to. Within the metacognitive activities, students' activities are dominantly characterised by monitoring. This dominance is not surprising as monitoring is inherent to every part of the learning process while orientation, planning, and evaluation strategies are applied mostly only before or after task performance, phases which were also underrepresented in the current results (Azevedo, Winters, & Moos, 2004; De Backer, Van Keer, & Valcke, 2012; Meijer et al., 2006; Moos & Azevedo, 2009b). Moreover, some metacognitive activities were not observed at all. Time planning and time monitoring, for example, could not be distinguished. This might be due to the specific characteristics of the task (Greene et al., 2011). As we wanted to create a learning environment closely connected to the normal conditions students make their homework in, no time constraints were given. So, it is possible that students did not feel the need to make a time planning and to subsequently monitor their time use. Further, metacognitive activities were generally more frequently applied during the Sudoku than during text studying. At the first measurement occasion, for example, 15.29% of the units reflected activities regarding task orientation during Sudoku-solving, whereas during text studying no task orientation could be detected. By examining the micro-level coding categories, it can be noticed that this difference in frequency is mostly due to the higher occurrence of detecting task demands, such as (re)reading task instructions. As the Sudoku-task entailed a written description of the game rules, it is possible that this behaviour was more prompted than in the text-studying task which entailed only an oral instruction (i.e., study the text as you would do in preparing for a test) and no written task instructions. However, also other orienting activities for text studying, such as reading the title and subheadings or scanning the text to get an overview, did not occur. In line with earlier studies, the students immediately started the learning task without a profound task orientation or planning (Malmberg, Järvelä, et al., 2014; Malmberg, Jarvenoja, & Jarvela, 2013; Merchie & Van Keer, 2014; Schellings & van Hout-Wolters, 2011), even though these activities are stressed in the light of effective learning (Broekkamp & van Hout-Wolters, 2007; Butler & Cartier, 2004; Meijer et al., 2006). Also activities regarding monitoring and self-evaluation occurred more frequently during Sudoku than during text studying, with monitoring in text studying primarily pertained to text comprehension, while monitoring in Sudoku-solving mainly concerned the detection and repair of errors (Veenman, 2011b). Interestingly, during solving the Sudoku, monitoring activities are more often accompanied with adjusting strategy use, which is lesser the case during text studying. For instance, if a student made the remark 'I do not understand that word', it was not necessarily followed by corrective actions, such as rereading the paragraph after confusion (García-Rodicio & Sánchez, 2014). During the Sudoku, on the other hand, detecting errors was mostly followed by correcting mistakes. These differential results between both tasks confirm that metacognitive activities can vary across tasks and domains (Braten & Samuelstuen, 2004; Hadwin, Winne, Stockley, Nesbit, & Woszczyna, 2001).

Regarding the cognitive learning strategies used during text studying, the results reveal that students, especially at the beginning of fifth grade, study in a rather one-sided manner mainly focusing on surface-level processing strategies aimed at basic memory or comprehension of the text (e.g., re-reading and reciting). They apply relatively few deep-processing strategies aimed at transformation or application of information (e.g., distinguishing between important and less important information, making connections with prior knowledge) (Broekkamp & van Hout-Wolters, 2007; Meneghetti, De Beni, & Cornoldi, 2007; Merchie & Van Keer, 2014). The selection of surface-level strategies might be due to the fact that students did not execute task orientation or planning prior to studying and did not know how to proceed and therefore relied on strategies they are most familiar with instead of selecting the most effective strategies (Greene, Hutchison, Costa, & Crompton, 2012; Malmberg et al., 2013). Further, students' selection and use of learning strategies can be influenced by the task demands (e.g., type of question on the test) and their perceptions of those demands (Broekkamp & van Hout-Wolters, 2007). In the current study, the instructions of the text studying task did not entail specific task demands. So, if the students are mainly accustomed to tests focusing on reproduction of knowledge, their use of rehearsal strategies may not be surprising. Next to the discussion of the occurrence of the different SRL strategies, the results also confirm that SRL is personalised and illustrate the individual variability in SRL processes (Greene & Azevedo, 2009; Pintrich, 2000). So, in investigating and stimulating SRL these individual differences should be taken in to account and explored further.

The development of SRL

It is expected that late primary school children undertake important steps in establishing a systematic study method in order to handle the upcoming increasing study requirements in secondary education (Meneghetti, De Beni, & Cornoldi, 2007). This was, however, not reflected in the present results. Except for making notes, the results did not show a significant change over time. Moreover, a decreasing trend of monitoring and adaptive strategy use during Sudoku could be observed. Although different variations of Sudoku were used throughout the subsequent measurement occasions, it is possible that solving the Sudoku became more automated, resulting in less efforts to monitor and control their strategy use. Overall, the results showed that metacognitive activities during Sudoku and text studying remained rather stable over time. The use of cognitive learning activities, on the other hand, mirrored more fluctuation. These results illustrate that SRL does not develop linearly or gradually (Schlagmüller & Schneider, 2002), confirming the complexity to become a skilful self-regulated learner. Further, it can be deduced that improvement in one kind of activities is not necessarily accompanied with the enhancement in other strategies. These results are, however, gathered among a specific group and a small number of participants. So, in further research, it would be interesting to investigate whether comparable results and patterns of change can be found among children with a less disadvantaged background.

Further, the individual variability in how students approach the tasks at each separate moment, could also be detected in how their strategy use developed over time (Kron-Sperl et al., 2008). Despite the fact that the overall results did not show a significant change over time, except for making notes, results suggest that there are intra-individual differences and a qualitative shift in students' strategy use could be detected. Some students, for instance, displayed more varied and more profound forms of monitoring activities or used the different learning strategies in a more strategic and integrated way. Given the complexity of SRL, such small qualitative improvements should be valued. Moreover, this finding supports the idea that the changes in how primary school children develop strategic learning are often qualitative rather than quantitative, implying that students will rather apply the strategy more adequately, than producing more acquired strategies. Further, these findings also indicate the value of not only considering the frequency of occurrence of SRL strategies, but also to adopt, like in current study, a more qualitative perspective in analysing TAP, especially among younger children.

Despite these small qualitative changes, students' use of metacognitive strategies and deep-level learning strategies was limited, even at the end of sixth grade. With the current method it is, however, not possible to detect the underlying reasons for this rather limited and surficial strategy use. According to Veenman (2011b), learners who exhibit a poor level of self-regulation may suffer from either an availability deficiency or a production deficiency. Learners with an availability deficiency do not possess the necessary knowledge and skills to perform the self-regulatory strategies, whereas learners with a production deficiency have the skills at their disposal, but do not spontaneously execute the available skills due to various reasons, such as not knowing when to enact a particular strategy or not recognizing the relevance of these skills (Veenman, 2011b; Veenman et al., 2006). If a student in a think-aloud session does not mention a particular learning activity (e.g., highlighting key words), the question remains whether he is unable to perform that activity, or whether he can do it but decides not to do it in the current situation for some reason (Schellings & van Hout-Wolters, 2011). In order to obtain this information, TAP should be combined with performance-based methods or direct measures, which explicitly asks student to enact the strategy allowing to assess students' competence to perform the targeted strategies and skills (Allen, Noel, Rienzi, & McMillin, 2002; Cromley & Azevedo, 2006). This would be of particular importance for educational practice as the promotion of SRL will be different depending on the underlying deficiency. As such, learners with an availability deficiency need to receive complete instruction and training, whereas additional prompting and cueing can be sufficient for learners to overcome their production deficiency (Veenman, 2011b). Although the current results cannot provide such specific implications for practice, some important insight and implications for practice can be formulated, as elaborated on further on.

Think-aloud protocols as method to assess late primary school children's SRL

The measurement of self-regulation processes is a highly challenging issue and has attracted the attention of many researchers (Efklides, 2006; Schellings & van Hout-Wolters, 2011). Given the novelty to use TAP among a younger sample, we would like to use this opportunity to elaborate more on this matter and to inform further researchers on the advantages and pitfalls of this method.

In contemporary debates regarding the assessment of SRL, TAP is put forward as a method to gain a more objective and process-oriented perspective upon SRL (Greene et al., 2011). More particularly, TAP captures participants' SRL processes concurrently with learning, making the data less vulnerable for students' memory distortions and interpretations of their thought processes (Veenman, 2011b). As such, this method results in rich, detailed, and process-oriented information of students actual use of SRL increasing our understanding of SRL which is highly valuable for researchers in SRL and educational practitioners interested in fostering SRL. The present study illustrated these advantages. An additional advantage of TAP, is that researchers can analyse SRL at multiple grain sizes by using a coding scheme detailing a hierarchy of specific and more general SRL processes. As such, both micro-level (e.g., reading task instructions) as well as macro-level processes (e.g., task orientation) – as an aggregate of micro-level processes – can be analysed (Greene & Azevedo, 2009). In the current study, these micro-level strategies also allowed to touch upon the quality of the performed actions as both basic and more sophisticated actions are incorporated. As such, we also exploit the opportunity to take a more qualitative perspective on the rich data protocols provided.

In order to make valid inferences, the TAP data preparation (i.e., segmenting and coding) must be done in a careful manner (Greene et al., 2011). In this study, a high interrater reliability was obtained demonstrating that TAP can be coded reliably. In this respect, we also want to underline the value of gathering both video and audio data and subsequently transcribing both verbal and non-verbal behaviour. First, this makes it possible to conduct a more informed and accurate coding. Second, it would have been very difficult to differentiate between closely related behaviours, such as rereading or literally reciting, without the video-data. When studying a text, for example, a student rereads the text, which is coded as 'rereading'. Another student literally recites the text, which would correctly be coded as reciting. Based on audio data alone, it is very difficult to distinguish both activities. However, combined with video-data it can be detected that the latter student is looking away from the text, so he is actually reciting rather than rereading. When memorising, for example, students quickly checked the source text, which students never verbalised during thinking aloud as it only takes a second. Although this is a very basic form of monitoring, it reflect students intention to check their progress. As such, the video-data allowed to some extent to counter the so called 'tip-of-the-iceberg phenomenon', implying that protocols may not be complete when learners do not or cannot verbalise all on-going thoughts and actions (Veenman, 2011a). Combining audio- and video data can especially be helpful in using TAP with primary school children, as it is possible that they may experience thinking aloud as more demanding.

Notwithstanding the clear advantages of TAP, we also want to address some drawbacks of TAP. First, as mentioned above, an advantage it is the provision of rich data. Collecting these data is however time- and labour intensive complicating application within larger samples (Veenman et al., 2006). Moreover, given this richness of the data and the possible multiple ways of analysing, it is not unlikely that researchers cannot see the wood for the trees. As such, TAP data are challenging to interpret, analyse, and report.

Second, based on TAP a researcher cannot always deduce the underlying motive of certain behaviour (Schellings & Broekkamp, 2011; Wolters et al., 2011), as it is not allowed to ask the participant to explain his or her thoughts, ideas, or motives in order to avoid reactivity (Ericsson & Simon, 1993) and students rarely spontaneously verbalize the motives for their actions. For example, when a student during TAP verbalizes 'OK, again three blocs accomplished, still two to go', a researcher will objectively code this statement as a monitoring activity, and more specifically as progress monitoring. However, it is not sure whether this statement does not also serves a motivational goal (e.g., being glad to almost having finished the task, so motivated to keep on working).

Third, in line with the criticism regarding the completeness of think-aloud protocols (Afflerbach & Johnston, 1984; Ericsson & Simon, 1980), we noticed that particularly motivational aspects of SRL are difficult to capture by means of TAP (Bannert et al., 2014), which can lead to an underestimation of the role of motivation in self-regulatory processes. This is particularly regrettable as research has not been able to profoundly document the way in which motivational aspects influence self-regulatory processes, while educational researchers nowadays increasingly acknowledge the role of motivation and emotions in addition to (meta)cognitive processes in learning (Cleary & Chen, 2009; Zimmerman & Schunk, 2008). In trying to explain why motivational aspects were hardly elicited in this study, it can be hypothesised that motivational processes operate on a more unconscious level, making these processes less accessible for verbalisation of the students (Bannert & Mengelkamp, 2008; Pintrich, Conley, & Kempler, 2003; Wolters et al., 2011; Young, 2005). Further, although researchers can try to make the think-aloud task as naturalistic as possible, the students can still perceive the situation as a 'test-situation', which might influence their behaviour by hampering to capture their spontaneous use of SRL. In this respect, the situation could complicate the performance of motivational strategies, like taking a short break or reward themselves to watch television. This also calls in the issue of ecological validity, as it is more difficult to conduct TAP in authentic contexts, such as at home when making homework (Greene et al., 2011). Consequently, in order to avoid underestimation of the role of motivation in self-regulatory processes, it is advisable to combine TAP with other measures, such as prospective or retrospective measures (e.g., self-report questionnaires, stimulated recall interviews) or concurrent measures (e.g., microanalytic protocols) (Ainley & Patrick, 2006; Cleary, Callan, & Zimmerman, 2012; Crombach, Boekaerts, & Voeten, 2003; Greene et al., 2011; Winne & Perry, 2000).

Limitations and further research

Besides the abovementioned suggestions for further research, additional suggestions can be made linked to the limitations of the current study. The aim of this study was to better understand SRL activities of late primary school students and how these develop over time. Giving this aim and the time- and labour intensity of the data gathering and analysis method, and in line with previous studies (Schellings & Broekkamp, 2011; Stromso, Braten, & Samuelstuen, 2003), a small number of participants were engaged in this study. This allowed us to capture the applied SRL behaviour and individual variability between students more in detail. However, the current study has a more descriptive nature and the small sample size limits the possibility of generalising the results, advocating for future larger scale research to complement the research findings. Besides engaging a larger sample of participants, it is also necessary to engage students with varying backgrounds (e.g., comparing students from disadvantaged backgrounds with students from advantaged backgrounds).

Second, as research indicates and as confirmed by the present results, SRL is moderated by the task and the context (Hadwin et al., 2001). Consequently, it can be assumed that varying the specific tasks used during TAP can reveal other self-regulatory strategies. Therefore, it is interesting to replicate this study in varying contexts and with different tasks, such as computer-based learning environments (Azevedo, 2007). Moreover, students' strategy adaption could be investigated in more detail by differentiating task demands (Broekkamp & van Hout-Wolters, 2007).

Third, although the current study provides rich descriptive results regarding late primary school students' SRL, further research should also explore the relationship with learning outcomes to gain more insight into the effectiveness of particular SRL strategies.

Fourth, in the current study the TAP data were analysed by investigating the frequency of occurrence of the SRL strategies. In addition to this approach, also a more qualitative approach was explored by considering micro-level activities, documenting which strategies the students combined and describing individual variability. As illustration also some results were reported as to how the different SRL processes were linked to each other. In this respect, it is interesting to investigate these interactions in a more detailed and profound way. Therefore, current analyses could be complemented with analyses such as process mining techniques, investigating how students' regulatory activities unfold over time to analyse the temporal order of spontaneous individual regulation activities (Bannert et al., 2014; Malmberg et al., 2013) and to investigate whether students are able to apply the strategies in an adaptive and effective way (Schellings et al., 2006). Using these process analyses in studies with larger sample sizes can be valuable to further enhance the theory building in SRL.

Finally, in this study, we mainly relied on a single source of data, namely think-aloud data. While this study confirms that this method provides rich data, combining TAPs with other types of data (e.g., self-report data, teacher ratings, stimulated recall) would gave a more fully picture of students' SRL.

Implications for practice

Based on the present study, some important insights and implications for practice can be formulated. First, the results underscore that acquiring self-regulated learning skills is a long-term developmental process and that it is imperative that primary school teachers provide their students with sufficient targeted instruction and opportunities for SRL (Malmberg et al., 2013; Pressley, 1995). As such, school teams in primary education should develop a clear and continuous curriculum and guidelines in order to ensure structured and consequent attention and integration of SRL practices throughout primary education.

Second, given the improvement in the organisational strategy of making notes, it can be deduced that teachers pay more attention to the instruction or stimulation of cognitive learning strategies. Also Cartier, Butler, and Bouchard (2010) found that primary school teachers of disadvantaged students were successful in embedding practices to engage students in the use of cognitive strategies, but that the practices enacted did not sufficiently drive students towards self-conscious, deliberate self-direction of learning. Therefore, teachers should be prompted to provide explicit instruction regarding metacognitive and motivational strategies as well. As SRL processes are closely related (Zimmerman, 2000), it is also preferable to address all three components of SRL simultaneously (Dignath et al., 2008). This is especially important since students encounter difficulties to simultaneously implement metacognitive, motivational, and cognitive strategies, as illustrated in the current results.

Third, teachers should also encourage students' integrated use of self-regulatory strategies and stress the interrelations between several SRL (sub-)processes. For example, students in the current study find it difficult to more purposefully monitor their learning process by more adequately using the information gathered during task orientation, to react properly on monitoring activities and to use different cognitive learning strategies in an integrated instead of rather isolated manner. In addition, the current results show that the quality of the displayed strategies can be approved. This implies that students are in need of more hands-on practice combined with sufficient and concurrent feedback on how to apply the strategies so they can increase the effectiveness of the strategies (Zimmerman, 2000). Further, given the task-specific nature of SRL, it is also advisable that the promotion of SRL is embedded across different subject areas and tasks.

Finally, the results underline the importance of taking the individual variability between children into account and of providing students with sufficient context and practice opportunities, so they can experience and discover the strategies that work best for them (Greene & Azevedo, 2009).

However, we realise that promoting SRL and tailoring instruction to each student's needs is not a matter of course in today's increasingly diverse classrooms (Butler, 2002). This also implies a call for further research. In-depth investigation, by means of observational research for example, of the specific instructional strategies primary school teachers use to stimulate all three SRL components and phases seem to be necessary (Spruce & Bol, 2014). In a second phase, it will be important to set up partnerships between researchers and practitioners when implementing self-regulation training programs (De Corte, Verschaffel, & Van de Ven, 2001) and to provide ongoing guidance and coaching of teachers (Abrami, Poulsen, & Chambers, 2004; Spruce & Bol, 2014).

Conclusion

In the literature and practice, active and deep-level engagement in a learning task is perceived as preferable. Unfortunately, this kind of SRL behaviour was rarely observed among at-risk late primary school children. Moreover, their strategy use remained rather stable over two school years and was generally characterised as basic and surface-level. This is worrisome, as they will meet increasing and more complex study requirement in the following years of their school career. These findings stress the importance of engaging primary school teachers in increasing efforts to empower students by cultivating positive self-motivational beliefs, expanding their repertoire of learning strategies, and helping them to apply these to school-related tasks in a self-regulated manner. Further, this study adds to the current debate on the measurement of primary school children's SRL by illustrating that TAP is a valuable tool to provide in-depth information opening more windows onto more process-oriented approaches, but concurrently indicating some flaws underlining the need for multi-method design. Given the frontier nature of the phenomena investigated in this study, the study has a more descriptive and explorative nature. Although it should be kept in mind that the current results and interpretation are based on a small scale study, it provides valuable insights and steppingstones for further research and practice.

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Appendix

Coding scheme for analysing the think-aloud protocols

Main coding categories	Subcategories	Specific indicators and examples
FORETHOUGHT AND PLANNING PHASE		
Task orientation	Exploring the task subject and constitution	Global document screening (e.g., [Student screens the front and back of the document.])
	Detecting task demands	Reading instructions[a] (e.g., I will first read the instructions. [Student reads the instructions aloud.])
		Rereading instructions before commencing the task[a] (e.g., I will read the instructions once again.)
		Paraphrasing task instructions (e.g., So, I must fill in a number from 1 through 9.)
		Examining and discussing the Sudoku-example[a] (e.g., Ok, here I see that every line contains a number from 1 through 9.)
		Asking for additional information before commencing the task (e.g., What do they mean with ‘block’?)
		Rereading the instructions after commencing the task[a] (e.g., Maybe it is better if I reread the instructions once again.)
	Activating prior knowledge	Activating prior content knowledge (e.g., I have already seen a movie about Penguins.)
		Activating prior metacognitive knowledge (e.g., I know how I have to solve a Sudoku, I already did that at home.)
	Becoming aware of one’s own task perceptions	Reflecting on task difficulty (e.g., It looks like a difficult puzzle, it won’t be easy.)
		Reflecting on task interest and/or value (e.g., I like reading texts about animals.)
Planning	Time management	Making a time schedule/allocating time (e.g. I will start with Sudoku, that won’t take long.)[c]
	Strategic planning	Depicting how to approach the task (e.g., I will first read the text, than I will underline keywords and I will try to memorise the text.)
Self-efficacy	Reflecting on one’s own competence to perform the task	(e.g., I am not good at solving a Sudoku)

PERFORMANCE PHASE		
Rehearsal strategies[b]	Rereading[b, d]	Rereading the source text[b] (e.g., [Student rereads the text out loud.]) Scanning and generating hypotheses[b] (e.g., [Student looks at a picture and says: ‘Oh, here they will tell something about the body parts’.) Rereading one’s own notes[b] (e.g., I will now reread my summary.)
	Memorising[b]	Rereading for memorising[b] (e.g., I will now reread the text to put it into my head.) Copying source text[b] (e.g., I am going to copy the text on my scratch paper.) Reciting source text[b] (e.g., [Student covers the source text with the scratch paper and tries to recite the text.]) Reciting one’s own notes[b,c] (e.g., [Student turns his scratch paper and tries to recite his notes.])
Organisational strategies[b]	Structuring text[b]	Highlighting key words during first time reading of source text[b] (e.g., I think that is important, I am going to highlight it.) Highlighting key words during subsequent reading of source text[b] (e.g., [Student highlights the word ‘insects’.]) Structuring one’s own notes[b] (e.g,, [Student highlights the main branches of his mind map.])
	Making notes[b]	Noting key words or key sentences during first time text reading[b] (e.g., [Student writes down: ‘Baby: swimming at 3 months’]) Noting key words or key sentences during subsequent text reading[b] (e.g., ‘Now I will also write down the most important things.’ [Student writes down: family of the bears]) Making a summary during first time text reading[b] (e.g., [During first time text reading, student makes a summary and writes down full sentences.]) Making a summary during subsequent text reading[b] (e.g., [After rereading the first paragraph ‘why is the giant panda so special?’, the student start to make a summary]) Making a graphical summary during first time text reading[b,c] (e.g., [While reading, the student makes a Mind Map]). Making a graphical summary during subsequent text reading[b,c] (e.g., I am going to make a Mind Map. [In the middle of the scratch paper, the student writes down: Barn owl])
Elaboration strategies[b]	Paraphrasing text content[b]	(e.g., [Student repeats a couple of sentences in own words])

	Relating text content to prior knowledge[b]	(e.g., So, the penguin weighs 5 kilos more than me.)
	Relating text contents[b]	(e.g., [Student looks at a picture and says: 'Here you see how a baby dragonfly becomes an adult).
	Providing personal remarks regarding the text content[b]	(e.g., Uh, that is disgusting!)
Motivational strategies	Positive self-talk[c]	(e.g., After checking her notes, the student writes down : 'well done')
	Making tasks more interesting[c]	(e.g., I am pretending that I am a teaching it to my classmates, it's more fun)
	Increasing task value[c]	(e.g., I will do my best, because I would like to get good marks)
	Self-reinforcement by promising themselves rewards[c]	(e.g., After this task, I am going to play outside.)
Monitoring	Comprehension monitoring	Detecting lack of comprehension/mistakes (e.g., I already have a 9 in this row. I made a mistake.) Awareness of understanding (e.g., Ok, now I understand it.)
	Monitoring of progress	Reflecting on the progress made (e.g., I have already done 6 blocks, 3 to go.) Reflecting on the available time and the time schedule[c] (e.g., 'Oh, it's already 4 o'clock.) Reflecting on the quality of the strategy use (e.g., I have highlighted too much keywords.)
	Interim checking	Quickly checking source text during reciting[b] (e.g., [During reciting, the students quickly looks at the text to check whether he remembered the information correctly.] Interim checking of the correctness or completeness of task performance (e.g., I am checking whether I did not make a mistake in this block.)
	Affective monitoring	Reflecting on the task difficulty (e.g., Pff, it is difficult.) Reflecting on one's own self-efficacy (e.g., I am really not good at solving a Sudoku.) Reflecting on task interest and/or value (e.g., I don't like making a Sudoku.)
Adjusting strategy use	Rereading the source text after confusion[b]	(e.g., [Student rereads a sentence after stating that he did not understood the sentence.]
	Correcting errors	(e.g., I will change the 2 into 4.]
	Selective navigation during solving the Sudoku[a]	(e.g., I can fill in 3 here and here, so I will wait and start with the following row.)
	Self-questioning supporting one's own learning process	(e.g., Ok, what is the most important word in this sentence?)

REACTION AND REFLECTION PHASE		
Self-evaluation	Evaluating learning outcomes after task performance	Checking the completeness of task performance (e.g., Did I forgot to fill in a number? Are there still empty spaces?) Checking the correctness of a solution (e.g., Let's have a look whether everything is correct [Student starts to count all the numbers per row.]) Recapitulating task instructions[c] (e.g., I had to fill in a number from 1 through 9 in each row, column, and block and that is what I have done.) Scanning the source text to check memorisation[b] (e.g., [Student quickly scans the text before handing in the documents]
	Evaluating learning processes after task performance	(e.g., I think I have studied the text thoroughly.)
	Affective reactions	Reflecting on task difficulty (e.g., It was harder than I thought) Reflecting on self-efficacy (e.g., I am quite good at solving Sudoku's) Reflection on task interest or value (e.g., That was interesting)
Off-task behaviour[e]		Asking practical questions, looking outside, etc. (e.g., Can I use my pencil?)

Note [a] Sudoku-specific behaviour. [b] Text studying-specific behaviour. [c] This category did not occur in the TAPs of the participants of the present study. [d] Participants' first time text reading before performing subsequent learning activities was not included into the analysis. [e] 7.31% of the units reflected off-task behaviour.

5 Stimulating self-regulated learning among primary school children with a low socio-economic and immigrant background by means of student tutoring

This chapter is based on:

Vandevelde, S., Van Keer, H., & Merchie, E. (2014). The challenge of promoting self-regulated learning among primary school children with a low socio-economic and immigrant background. Manuscript accepted for publication in *Journal of Educational Research*.

Chapter 5
Stimulating self-regulated learning among primary school children with a low socio-economic and immigrant background by means of student tutoring

Abstract

This study explores the effects of student tutoring as an approach to provide support on self-regulated learning (SRL) to fifth and sixth graders with a low socio-economic and/or immigrant background. In total, 401 Flemish (Belgium) students participated. A quasi-experimental study with pretest, posttest, and retention test control group design was used, combining teacher ratings, self-report questionnaires, and think-aloud protocols. The teacher rating results show a significantly positive effect from pretest to posttest for the experimental condition, but this was not maintained at the retention test. The questionnaire and think-aloud results reveal no significant effects on students' SRL. However, differential effects depending on students' motivational profile were found. This study illustrates the complexity of promoting SRL among primary school children with a low socio-economic and/or immigrant background, recommending further research into conditions and factors influencing the effectiveness of student tutoring programmes promoting SRL.

Introduction

As research documented significant educational disadvantages for students with a lower socio-economic and/or immigrant background (OECD, 2004, 2013b; Park & Sandefur, 2010), providing an equitable distribution of educational opportunities has become an important challenge for educational systems. This calls for an examination of educational methods that can enhance the educational opportunities of these target groups. As studies have indicated that learners who possess and display self-regulated learning strategies experience more successful educational trajectories (Artelt, Baumert, McElvany, & Peschar, 2003; Pintrich, 2004; Winne, 2005; Zimmerman, 2002), providing students with a low socio-economic and/or immigrant background additional instructional resources regarding self-regulated learning (SRL) might improve their educational position. Unfortunately, while these students require more instruction and practice in SRL, teachers of disadvantaged students seem to opt more frequently for teacher-centred learning environments which are less in line with conditions promoting SRL (Hornstra, Mansfield, Van der Veen, Peetsma, & Volman, in press). In promoting SRL, close and individualised guidance seem to be preferable (Butler, 2002; Veenman, van Hout-Wolters, & Afflerbach, 2006). Student tutoring, a method in which children receive guidance in small groups from higher education students, might be an interesting approach to provide such individual support to students at risk of educational failure (Vandevelde, Van Keer, & De Wever, 2011; Barley et al., 2002; Cassio, 2008; Hock, Pulvers, Deshler, & Schumaker, 2001; Ritter, Barnett, Denny, & Albin, 2009). However, to our knowledge, the potential of enhancing SRL by means of student tutoring has not been explored yet (for an exception see Vandevelde et al., 2011). The present study intends to fill this gap by investigating the effects of student tutoring as a method to provide support on SRL to fifth and sixth graders with a low socio-economic and/or immigrant background.

Educational inequality

With respect to educational inequality, student background remains one of the most powerful factors influencing performance (Dronkers, 2010; OECD, 2004, 2013b). Research reveals that students with a low socio-economic background on average tend to perform less well at school than their peers (OECD, 2004, 2013b). Although Flanders (Belgium) has high average performance levels, student performance is comparatively strongly related to socio-economic background (OECD, 2004, 2013a) and shows one of the largest disparities between native and immigrant students, even when students' socio-economic background is taken into account (OECD, 2006, 2013b; Park & Sandefur, 2010; Sierens, Van Houtte, Loobuyck, Delrue, & Pelleriaux, 2006). In comparison with their more privileged peers, students with low socio-economic and immigrant backgrounds are less frequently enrolled in pre-primary education, are over-represented in technically and vocationally oriented programmes, are underrepresented in higher education and educational delay at primary and secondary level is more often observed within this student group (Groenez, Van den Brande, & Nicaise, 2003; Sierens et al., 2006).

In sum, despite several policy actions in the past decades undertaken by the Flemish government (Nicaise & Desmedt, 2008), the performance of these students generally lies behind the performance of students with a higher socio-economic and/or non-immigrant background. Providing additional instructional resources for students with a more socio-economically disadvantaged and/or immigrant background, is one of the possibilities proposed in the literature to enhance their educational opportunities (OECD, 2013a). Offering additional support to acquire and strengthen their SRL might help them to fulfil their educational trajectories more successfully. Additional attention to SRL is especially warranted since research shows that these target groups encounter more difficulties with displaying SRL (Pappas, Ginsburg, & Jiang, 2003) and that teachers find it more difficult to foster SRL in these groups (Hornstra, van der Veen, Peetsma, & Volman, in press). In the following sections, we elaborate further on this matter.

Self-regulated learning

As the concept of SRL has received a great deal of attention in educational research and educational psychology and has been studied from diverse theoretical perspectives, different models, conceptions, and definitions of SRL have emerged in the literature (Boekaerts & Corno, 2005; Dinsmore, Alexander, & Loughlin, 2008; Martin & McLellan, 2008; Pintrich, 2004; Schunk, 2005; Zeidner, Boekaerts, & Pintrich, 2000). Based on general assumptions shared by different models of SRL, Pintrich describes SRL as “an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behaviour, guided and constrained by their goals and the contextual features in the environment” (Pintrich, 2000, p. 453).

This description illustrates the complexity and multi-component character of SRL, including a metacognitive, cognitive, and motivational component. The metacognitive component refers to planning, setting goals, organising, self-monitoring, and self-evaluating during the learning process (Boekaerts, 1999; Pintrich, 2004; Veenman, 2011b). The strategic or cognitive component describes how learners approach their learning tasks, choosing from a repertoire of tactics and learning strategies they believe are best suited to tackle the task and subsequently applying them appropriately (Azevedo & Cromley, 2004; Boekaerts, 1999; Hadwin, Wozney, & Pontin, 2005; Pintrich, 2004) and how they select, structure, and create environments that optimise learning (Perry, Phillips, & Dowler, 2004; Winne, 2001; Zimmerman, 1990). In addition, students’ use of (meta)cognitive strategies is not merely a question of skills, but also a question of motivation (Boekaerts, 1995; Pintrich, 1999; Wolters, 2003; Zimmerman & Moylan, 2009). Consequently, SRL involves motivational aspects as well, such as self-efficacy beliefs and task interest (Pintrich, 2004; Wolters, 2003; Zimmerman & Schunk, 2008).

Following the multi-component character of SRL, students will ideally analyse the task requirements, mobilise and evaluate their prior knowledge, and select appropriate strategies before engaging in a task. These actions enable them to monitor their behaviour in terms of their goals and self-reflect on their increasing effectiveness. Students showing high levels of SRL, during task performance, will use effective strategies to organise, code and rehearse information. They establish a productive work environment, manage their time effectively, monitor their motivational beliefs, and persist despite hindrances or distractions. These learners will also display high levels of self-motivation and hold positive beliefs about their capabilities. After a task, they preferably self-evaluate their performance and make strategy attributions instead of ability attributions. This leads to greater personal satisfaction with their learning progress and to further efforts to improve their performance (De Corte, Mason, Depaepe, & Verschaffel, 2011 ; Schunk & Ertmer, 2000; Zimmerman, Bonner, & Kovack, 2002).

As research has shown that SRL leads to success in and beyond school (Pintrich, 2004; Zimmerman, 2002), SRL has become an important educational goal (Boekaerts, 1999; Zimmerman, 2002). Within the research field of SRL, most studies have involved students from secondary or higher education (Winne & Perry, 2000) due to the long-held belief that young children (i.e., preschool and early primary school children) are unable to self-regulate their learning (Paris & Newman, 1990; Schunk, 2001; Zimmerman, 2001) and that important self-regulated learning skills, like metacognitive skills, only emerge at the age of 8 to 10, and develop during the years thereafter (Veenman et al., 2006). Consequently, research on primary school children's SRL remains limited (Winne & Perry, 2000; Zeidner et al., 2000).

During the last decade, however, an increasing number of studies provided empirical support indicating that young children can and do engage in SRL-activities (e.g., Annevirta & Vauras, 2006; Perry et al., 2004; Schneider, 2008; Whitebread et al., 2009; Wigfield, Klauda, & Cambria, 2011) and that SRL can already be fostered by instructional guidance at primary school (Dignath, Buettner, & Langfeldt, 2008; Perels, Gürtler, & Schmitz, 2005; Stoeger & Ziegler, 2008). SRL and fostering SRL become increasingly important in transition periods in which students switch from a more closely monitored environment (i.e., primary education) to an environment (i.e., like secondary education) in which greater independence is expected and students have to plan, monitor, and evaluate larger portions of learning by themselves (Cleary & Zimmerman, 2004; Dembo & Eaton, 2000; Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013; Wingate, 2007). Therefore, early adolescence represents a critical period for the acquisition of an effective study method, which students will need when confronted with the increased expectations for academic productivity and more intensive and demanding learning environments (Cornford, 2002; Hamman, Berthelot, Saia, & Crowley, 2000; Meneghetti, De Beni, & Cornoldi, 2007). To meet these expectations, students need a repertoire of self-regulated learning strategies they can access and utilise.

Unfortunately, however, research indicates that students encounter difficulties applying these strategies in an effective and efficient way (Pintrich, 2002, 2004; Schunk & Ertmer, 2000; Winne & Nesbit, 2009). The use of self-regulated learning strategies largely varies among learners (Annevirta & Vauras, 2006; Perry et al., 2004; Winne, 2005; Zimmerman, 2002), possibly due to a deficiency of the necessary metacognitive knowledge and skills, students' beliefs that they cannot successfully execute self-regulated learning strategies, or a lack of motivation to apply the more demanding strategies (Veenman et al., 2006; Zimmerman, 2001). Moreover, many students develop negative self-motivational beliefs (e.g., like decreasing self-efficacy beliefs regarding their SRL) or show a decline in their motivation when they transit to secondary school (Cleary & Chen, 2009; Corpus, McClintic-Gilbert, & Hayenga, 2009; Eccles, 2005; Pajares, 2002; Spinath & Spinath, 2005; Usher & Pajares, 2008). This is worrisome, because as students lose motivation for, and confidence in, their self-regulated learning strategies and practices, they are less likely to employ them and will struggle to deal with more demanding learning environments. Although research specifically focusing on SRL among specific groups is scare (Pintrich & Zusho, 2007; Zeidner et al., 2000), students from more socio-economically disadvantaged backgrounds have been found to show less SRL behaviour (Pappas et al., 2003). Students from a low socio-economic background and ethnic minority students also have more difficulty engaging in motivated behaviour and investing effort in school towards the end of primary school (Hornstra, 2013). Given these findings, researchers and educational practitioners emphasize the importance of promoting SRL already in primary education (Dignath et al., 2008; Perry et al., 2004; Postholm, 2010; Stoeger & Ziegler, 2011).

Promoting self-regulated learning

Although children in most cases do not spontaneously or effectively regulate their learning (Schneider, 2008; Schunk, 2001), research indicates that SRL is trainable (Dignath et al., 2008; Paris & Paris, 2001; Perels et al., 2005; Schneider, 2008; Stoeger & Ziegler, 2008; Zimmerman et al., 2002). Based on the literature, several guidelines can be deduced regarding how to guide and coach students' self-regulated learning processes.

First, according to a social cognitive perspective, the development of SRL starts on an observational level (i.e., vicarious induction of a skill from a proficient model), then progresses to an emulation level (i.e., imitative performance of the general pattern or style of a model's skill receiving guidance, feedback, and social reinforcement during practice from the model to increase accuracy), then evolves to a self-controlled level (i.e., independent display of the skill under structured conditions), and finally reaches a self-regulated level (i.e., adaptive use of skill across changing personal and environmental conditions) (Zimmerman, 2001). This social cognitive model suggests that the development of SRL begins with the most extensive social guidance at the first level, and this social support is systematically reduced as learners acquire underlying self-regulated learning skills (Schunk, 2001; Winne, 2005; Zimmerman, 2001). Consequently, there should be a shift from external modelling of the regulation towards students taking control and demonstrating SRL (Hadwin et al., 2005). In order to evolve from external regulation to co-regulation and to finally reach self-regulation, scaffolding is a critical issue whereby models provide calibrated support based on an ongoing diagnosis of the students' level of understanding (Puntambekar & Hübscher, 2005). In educational settings, teachers can serve as models by demonstrating the use of strategies and verbalising their thought processes (Kistner et al., 2010; Zimmerman, 2000). In a latter phase, they can encourage students to take more responsibility by prompting them to perform SRL while providing feedback and challenging the student to analyse, plan, monitor his thinking, and to evaluate the outcome. In those cases, the teacher reverts from being a model to a more coaching role (Larkin, 2009).

Second, besides modelling-scaffolding-fading, teachers can also create a supportive learning environment that enables students to engage actively in their learning process (Kistner et al., 2010; Perry et al., 2004). Such a powerful environment gives students the opportunities to seek challenges, to take responsibility, and to reflect on their progress (Paris & Paris, 2001). More concretely, teachers (a) engage students in complex, open-ended activities and offer them choices and opportunities to control the level of difficulty and challenge (Boekaerts, 1997; Paris & Paris, 2001; Perry et al., 2004); (b) provide instrumental support to ensure students' application of independent, academically effective forms of learning and encourage support through peers (Perry et al., 2004); (c) create situations that make strategy use observable and salient (such as during discussion, tutoring) (Paris & Paris, 2001); (d) provoke students to engage reflectively in their cognitive, motivational, and metacognitive strategy use and as such evocate students' explicit awareness and reflection (Askell-Williams, Lawson, & Skrzypiec, 2012; Butler, 2002); (e) support attribution of improved performance to strategy use instead of to ability or luck (Butler, 2002; Pintrich, 2004); and (f) use non-threatening evaluation practices that encourage students to focus on personal progress and promote a climate in which errors are opportunities from which to learn (Perry et al., 2004).

Third, although both modelling and creating powerful learning environments are important to enhance students' SRL, it is mostly not sufficient. In these cases, explicit instruction of the strategies is needed, especially for low achievers and students who encounter more difficulties with SRL (Kistner et al., 2010; Weinstein, Husman, & Dierking, 2000). During explicit instruction, teachers do not only model the strategies, but also provide specific strategy information so that students become aware of the how, when, and why to apply strategies (Kistner et al., 2010; Paris & Paris, 2001).

Ideally, the above described guidelines to promote SRL are combined by (a) introducing self-regulated learning strategies by modelling, (b) providing explicit instruction so students acquire knowledge on the how, when, and why to apply strategies, and (c) providing various practice opportunities by creating powerful learning environments accompanied by close guidance and feedback to optimise students' self-regulated learning strategies (Pressley & Woloshyn, 1995). Unfortunately, research shows that in today's classrooms few teachers effectively and explicitly prepare their pupils to learn on their own and external regulation prevails largely over self-regulation (Vandevelde, Vandenbussche, & Van Keer, 2012; Boekaerts, 1997; Cornford, 2002; De Corte et al., 2011 ; Pintrich, 2002; Zimmerman, 2002). Especially teachers of disadvantaged students seem to opt more frequently for teacher-centred learning environments, partly due to their beliefs that their students lack the characteristics necessary for more innovative, and autonomy-supportive learning environments (Hornstra et al., in press). Consequently, students from ethnic minorities or socio-economically disadvantaged backgrounds may be more accustomed to traditional ways of teaching, which are less in line with conditions promoting SRL. However, these students actually require more instruction and practice in SRL (Dembo & Eaton, 2000; Veenman & Verheij, 2003; Weinstein et al., 2000), as they have less experience and prior knowledge about effective strategies (Dembo & Eaton, 2000; Larkin, 2009).

The abovementioned research findings highlight the importance of discovering ways to promote SRL, preferably from primary education on. Consequently, numerous studies and self-regulation training programmes were set up and different approaches were examined: classroom-based training (e.g., Perels, Dignath, & Schmitz, 2009; Stoeger & Ziegler, 2008), computer-based training (e.g., Graesser, McNamara, & VanLehn, 2005; Kramarski & Gutman, 2006), and school-based programmes (e.g., Cleary & Zimmerman, 2004). However, to our knowledge, the potential of enhancing SRL by means of student tutoring has not yet been explored (for an exception see Vandevelde et al., 2011). Moreover, most previous intervention studies have combined the instruction of self-regulated learning strategies with domain-specific strategies, such as mathematics (e.g., Fuchs et al., 2003; Mevarech & Kramarski, 2003; Perels et al., 2009), reading/writing (e.g., Bimmel, Bergh, & Oostdam, 2001; Schünemann, Spörer, & Brunstein, 2013; Souvignier & Mokhlesgerami, 2006), and science (e.g., Leopold, den Elzen-Rump, & Leutner, 2007), reporting on the effects of SRL training on (domain-specific) learning performance, without assessing its impact on students' SRL as such (Veenman et al., 2006).

Promoting self-regulated learning by means of student tutoring

Student tutoring refers to 'the practice of having students from universities and colleges tutor pupils in primary and high school classrooms under the guidance of the class teacher' (Topping & Hill, 1995, p. 15). Student tutoring is often confused with 'peer tutoring', which is defined as 'people from similar social groupings who are not professional teachers helping each other to learn, and learning themselves by teaching' (Topping, 1996, p. 322). The term 'peer' implies equality of age and position. Within peer tutoring, the tutor (i.e., the student taking a supportive role) and tutee (i.e., the student receiving help and support) can be from the same class (i.e., same-age peer tutoring) or a different class (cross-age peer tutoring). In the case of student tutoring, however, tutor (i.e., student from higher education) and tutee (i.e., student from primary or secondary education) have a clearly different educational level and differ more in age and position compared to peer tutoring. Although student tutors are not professional tutors or regular school teachers, the student tutor is the more capable, knowledgeable, and experienced student with a supportive role, while tutees are less experienced pupils receiving help (Topping & Hill, 1995). Student tutoring programmes can vary according to a number of dimensions: tutee characteristics (e.g., learning delayed, socio-economically disadvantaged, drop-out risk), tutor characteristics (e.g., community volunteers, pre-service teachers), curriculum (e.g., reading, mathematics, science), contact arrangements (e.g., one-to-one, small groups), and time (e.g., class time, recess time, after school) (Gordon, Morgan, O'Malley, & Ponticell, 2007; Topping & Hill, 1995).

Taking the general characteristics of student tutoring into account, student tutoring can provide a valuable learning context to promote SRL. A first important characteristic is the more individualised help tutees receive, as tutoring occurs in one-to-one settings or in small groups. When promoting SRL, it is important to build from students' existing knowledge and skills and to provide calibrated support based on an ongoing diagnosis of the students' level of understanding (Butler, 2002; Puntambekar & Hübscher, 2005). This support is individualised not only for different learners with various levels of prior knowledge and skills, but it also changes for each learner over a particular task (Puntambekar & Hübscher, 2005). Especially young children seem to profit from a more close and individualised guidance to refine their self-regulated learning processes (Zimmerman & Martinez-Pons, 1990). However, tailoring instruction to each student's needs is a challenge in today's increasingly diverse classrooms (Butler, 2002). In this respect, teachers experience the diversity between their pupils – in combination with time pressure – as a factor hampering SRL stimulation (Vandevelde et al., 2012). These individual differences and the need for personal guidance appear to be of particular relevance to advocate tutoring initiatives. Because student tutoring mostly occurs in small groups or in one-to-one settings, tutors can act as models and provide explicit instruction when needed, and are equipped to assess individual differences among their tutees, to fine-tune their support based on students' changing knowledge and skills, and in doing so to establish the zone of proximal development and to engineer stimulating learning environments (cf. modelling-scaffolding-fading and explicit instruction; Gordon et al., 2007; Graesser, Person, & Magliano, 1995).

Second, the benefits of student tutoring can be explained by a greater social involvement between tutor and tutee, tutors serving as a role model, the provision of immediate and relevant feedback, more active and interactive learning, increased time on task, and a better alignment between what students know and the instructional task (Chi, Siler, Jeong, Yamauchi, & Hausmann, 2001; Gaustad, 1992; Gordon et al., 2007). Due to these specific features of tutoring, a powerful learning environment is created in which tutees are empowered to take ownership of their learning (Topping & Ehly, 2001) and in this way, tutees are encouraged to regulate their learning process.

Third, the affective component of tutoring might be a powerful steppingstone for important motivational concepts regarding SRL. A trusting relationship with a tutor who holds no position of authority might facilitate self-disclosure of ignorance and misconception, enabling subsequent diagnosis and correction (Topping & Ehly, 2001). The tutor's modelling of enthusiasm, competence, and the possibility of success can influence the self-confidence and self-esteem of the tutee. As the tutoring occurs in small groups, it is expected that the students receive more praise and encouragement than in group instruction. The additional attention itself can be motivating. These affective processes can foster greater learning motivation, self-esteem, and self-confidence (Gaustad, 1992). These aspects of tutoring are particularly valuable when considering students at-risk of school failure, frequently characterised by low self-esteem or in need of attention and relatedness (Hamre & Pianta, 2001; Karsenty, 2010). As these characteristics of student tutoring are in line with the key instructional tools promoting SRL (modelling, scaffolding, explicit instruction, creating powerful learning environments), student tutoring might be a cost-effective avenue to provide additional assistance to educationally disadvantaged students in order to optimise their SRL.

Notwithstanding the many effect studies on peer tutoring, research on the effects of student tutoring remains rather scarce despite the wide use in practice (Morris, 2006; Ritter et al., 2009). Although outcomes vary according to the particular student tutoring programme's design, research generally shows positive outcomes for both tutees and tutors on the cognitive, affective, and social level (Cohen, Kulik, & Kulik, 1982; Gordon et al., 2007; Ritter et al., 2009; Topping & Hill, 1995). Positive outcomes for tutees include increased aspirations, improved basic skills, deeper learning, improved motivation, affective and attitudinal gains, intrinsic interest in the subject matter, and a reduction in tutee drop-out (Cohen et al., 1982; Elbaum, Vaughn, Hughes, & Moody, 2000; Gordon et al., 2007; Ritter et al., 2009; Slavin, Lake, Davis, & Madden, 2011; Topping & Hill, 1995). However, these positive effects mainly result from studies focusing on reading. Student tutoring programmes regarding other subjects, like mathematics, reveal limited effects (Smith, Cobb, Farran, Cordray, & Munter, 2013; Vadasy, Jenkins, Antil, Wayne, & O'Connor, 1997). Concluding, studies on the effectiveness of student tutoring are rather scarce and inconclusive as the magnitude of effects varies considerably. These findings stress the need for further research (Gordon et al., 2007; Ritter et al., 2009). Additionally, previous student tutoring studies have focused on specific subjects as the curriculum of tutoring and not on cross-curricular skills, like SRL (Gordon et al., 2007; Topping, 1998). Therefore, we explore whether student tutoring is an effective strategy for improving SRL.

The role of motivation

In order to gain more insight into the complexity of SRL and why some students do or do not engage in SRL, numerous researchers have studied the interactive relations between student characteristics and SRL, including gender (e.g., Kitsantas, Steen, & Huie, 2009; Virtanen & Nevgi, 2010), prior knowledge (e.g., Greene, Costa, Robertson, Pan, & Deekens, 2010; Moos & Azevedo, 2008), epistemic beliefs (e.g., Muis & Franco, 2009; Pieschl, Stahl, & Bromme, 2008), and motivational aspects (e.g., Braten, Samuelstuen, & Stromso, 2005; Pajares, 2008). In this study, we focus on the motivational aspects as a great deal of studies have examined and confirmed the significant role of motivational aspects with regard to students' engagement in SRL and the promotion of SRL (Butler, 2002; Pintrich, 2004; Schunk & Ertmer, 2000; Weinstein, Jung, & Acee, 2011; Wolters, 2003; Zimmerman & Schunk, 2008). In previous studies, different motivational aspects have been identified and investigated as to the function they serve in SRL, such as task value (e.g., Neuville, Frenay, & Bourgeois, 2007), self-efficacy (e.g., Pajares, 2008), causal attributions (e.g., Zimmerman & Kitsantas, 1997), motivational strategies (e.g., Wolters, 2003), and motives for learning (e.g., Vansteenkiste, Simons, Lens, Soenens, & Matos, 2005). The present study focuses on two key motivational constructs frequently addressed in research, namely students' self-efficacy beliefs and their motives to engage in learning tasks.

Following the social-cognitive perspective, self-efficacy is considered a powerful motivational factor in SRL and refers to students' personal beliefs about their abilities to perform tasks and succeed in activities (Pajares & Valiante, 2002; Usher & Pajares, 2006; Zimmerman, 2000). Students who believe that they are capable of performing academic tasks use more cognitive and metacognitive strategies, and, regardless of previous achievement or ability, they work harder and persist longer when confronted with academic challenges or difficulties (Pajares, 2008; Schunk & Ertmer, 2000).

In conceptualising students' motives to engage in learning tasks, we build upon the Self-Determination Theory which has been established as a well-validated and coherent theoretical framework for the conceptualisation and investigation of motivation (Deci & Ryan, 2004; Reeve, 2002; Vansteenkiste & Lens, 2006). Self-Determination Theory integrates both social-cognitive constructs and human needs (Pintrich, 2003) and expands the traditional distinction between intrinsic and extrinsic motivation by differentiating extrinsic motivation into types of regulation that vary in their degree of relative autonomy (Ryan & Deci, 2000). Autonomous motivation refers to engaging in an activity for its own enjoyment or inherent satisfaction (i.e., intrinsic motivation) or because one identifies with the personal importance of a behaviour (i.e., identified regulation). In contrast, when a student undertakes an activity for some instrumental value or external reason (i.e., extrinsic regulation) or to comply with internal pressure or to avoid feelings of guilt and shame (i.e., introjected regulation) he is motivated for controlled reasons (Deci & Ryan, 2000; Ryan & Deci, 2000). Several studies show that autonomous motivation is associated with a variety of positive learning outcomes, like greater intention to persist (Hardre & Reeve, 2003), more deep-level learning (Vansteenkiste, Zhou, Lens, & Soenens, 2005), and more frequent use of adaptive metacognitive strategies, such as planning and time management (Sierens, Vansteenkiste, Goossens, Soenens, & Dochy, 2009; Vansteenkiste, Zhou, et al., 2005).

These findings result from a variable-oriented approach examining the unique effects of different types of motivation (e.g., autonomous motivation or controlled motivation) (Vansteenkiste, Sierens, Soenens, Luyckx, & Lens, 2009). However, multiple reasons might drive study behaviour simultaneously and students can combine diverse motives or types of motivation. This has led researchers to examine motivational components via a more person-centred approach by identifying motivational profiles. Based on the Self-Determination Theory, Vansteenkiste et al. (2009), for example, found four motivational profiles in students: a good quality motivation group (i.e., high autonomous, low controlled motivation); a poor quality motivation group (i.e., low autonomous, high controlled); a low quantity motivation group (i.e., low autonomous, low controlled); and a high quantity motivation group (i.e., high autonomous, high controlled). The good quality motivation group displayed the most optimal learning pattern.

Given the positive relation between students' motivational profile and their learning, one might expect that students' motivational profiles also relate to their responsiveness to educational interventions, and an intervention on SRL in particular. Exploring this possible influence might also inform us on the complex interplay between student characteristics and the effectiveness of an intervention targeting SRL. However, to our knowledge, prior research has not yet explored such group-specific evolutions of SRL.

The present study

Given the disadvantaged educational position of students with a low socio-economic and/or immigrant background, providing additional instruction and support regarding SRL may be a valuable strategy to empower them. As research underlines the importance of effectively promoting SRL in primary education and indicates that SRL becomes increasingly important during transition periods, the present study specifically focuses on fifth and sixth graders, since at this age children are approaching the transition from primary to secondary school in Flemish education. We opted for student tutoring as an approach to stimulate SRL for several reasons. First, the characteristics of student tutoring, and especially the individualised help, are in line with the main recommendations regarding the promotion of SRL. Second, within the research field of SRL, stimulating SRL by means of student tutoring has not been studied before. Similarly, within the research field of tutoring, studies into the effects of student tutoring programmes on SRL instead of specific subjects, do not exist. As such, student tutoring can be considered as an innovative approach to stimulate SRL.

In sum, the main aim of the present study is to investigate the effectiveness of student tutoring as an innovative approach to stimulate late primary school children's self-regulated learning skills applied across specific task boundaries and domains of SRL and explicitly focusing on the assessment of SRL itself. More particularly, the focus is on fifth and sixth graders with a low socio-economic and/or immigrant background. Given the potential influence of students' self-efficacy beliefs and motives to learn in this respect, we also study the differential effects of student tutoring for groups of students clustered on both their motivation and self-efficacy. The following research questions are addressed: (1) what is the initial state of SRL among students with a low socio-economic and/or immigrant background; (2) how effective is a student tutoring programme at promoting SRL among students with a low socio-economic and/or immigrant background; (3) to what extent does the effectiveness of the programme vary for students with different motivational profiles?

Method

Participants

In the experimental group, 106 students (63 fifth graders, 43 sixth graders, M_{age}= 10.94, SD_{age}= 0.82) from six classes from four Flemish (Belgium) inner-city schools participated as tutees in a student tutoring programme. Thirty-eight first master students in Educational Sciences at Ghent University (35 women, 3 men) were engaged as tutors. In the control group, 295 students (152 fifth and 143 sixth graders, M_{age}= 10.65, SD_{age}= 0.88) from 16 classes from five Flemish (Belgium) inner-city schools participated. In total, 22 classroom teachers participated (M_{age}= 41.34, SD_{age}=8.95). Based on criteria of the Flemish Department of Education 85% of the participants were students with low socio-economic and/or immigrant background.

Design

A quasi-experimental study with a pretest, posttest, and retention test control group design was used. Schools were randomly assigned to either the experimental condition or the control condition. The intervention took place during 3 successive months: 10 student tutoring sessions of 100 minutes each were organised once a week. Before the intervention, the pretest was administered (September 2010). Immediately after the intervention (December 2010) and two months after the intervention (March 2011), the posttest and retention test were administered respectively.

Intervention

The intervention was characterised by student tutoring focusing on SRL. The aim of the intervention was to empower students with a low socio-economic and/or immigrant background by cultivating positive self-motivational beliefs, expanding their repertoire of learning strategies, and helping them to apply these to school-related tasks in a self-regulated manner. As the vast majority of the students of the participating classes were students from low socio-economic and/or immigrant background, all students from the participating classes participated as tutees and no further selection of tutees took place. Tutoring sessions took place during school hours in small groups of two or three tutees per tutor. Tutees' classroom teachers were responsible for composing the groups and tutors were randomly assigned to these groups. For the tutors, the tutoring assignment was a formal part of a 7-credit course 'coaching and guidance'.

First, the intervention was developed taking into account theoretical and empirical preconditions promoting SRL (Schunk, 2001; Zimmerman, 2002). These insights were incorporated into the intervention by: (a) tutors functioning as models providing explicit instruction and scaffolding and fading their support throughout the intervention; (b) tutoring in small groups guaranteeing close guidance and feedback; and (c) alternation between explicit instruction and deliberate practice applying the strategies across multiple contexts and tasks. Further, since research on SRL indicates that addressing all three main components of SRL is more effective than training selected components (Dignath et al., 2008; Leopold et al., 2007; Perels et al., 2005; Schunk & Ertmer, 2000), a multidimensional approach was opted for and all three SRL components were addressed (see Appendix A for an overview of the sessions).

Second, the characteristics of effective student tutoring were incorporated. As researchers have consistently reported that well-structured tutoring programmes are more effective (Cohen et al., 1982; Gordon et al., 2007; Ritter et al., 2009), a tutoring curriculum script was designed, structuring the content of the sessions and ensuring deliberate practice and structure. The curriculum script consisted of learning material for the tutees and a manual for the tutors detailing the learning goals and providing the tutors with scenarios to address the selected SRL components (see Appendix A). As the curriculum script structured the content of the sessions, the tutors had to be responsive to adjust the tutoring process to the needs of the tutees by means of dynamic scaffolding. Further, to ensure the quality of tutoring and taking into account that tutoring programmes in which tutors receive prior training yield better outcomes (Cohen et al., 1982; Goodland, 1995; Gordon et al., 2007), the tutors received prior training and ongoing support. The training's content was twofold. On the one hand the tutors were trained in generic tutoring skills (e.g., questioning, prompting, scaffolding, providing feedback, and establishing a supportive relation) (Gordon et al., 2007; Graesser et al., 1995; King, 1997). On the other hand, the training addressed promoting autonomous motivation and SRL (e.g., offering choices, opportunities for students to evaluate themselves and others, creating intrinsically motivating learning contexts, fading support). To provide ongoing support for the tutors, two interim small-group supervision sessions with the university instructors, three group meetings with the tutees' teacher, and individual feedback sessions with the university instructors were organised. Based on individual feedback, tutors were encouraged to optimise their tutoring actions.

The fidelity of implementation was assessed in terms of surface (i.e., amount and duration of sessions, coverage of topics in the curriculum) and quality features (i.e., quality of tutoring) (Gersten et al., 2005). First, weekly reports of both the classroom teachers and the tutors, confirmed that the duration and amount of tutoring sessions was respected by the tutors and that all the topics of the curriculum script were covered. Second, observations of the student tutoring activities were conducted on a weekly basis by the researchers throughout the entire the intervention duration and both students' general tutoring skills as their specific activities to promote SRL were evaluated. In total, each student was observed twice. Based on these observations, tutors received a score from 0 to 20, with a mean score of 13.47 (*SD*=1.63). Since international objective standards regarding the quality of tutoring activities are lacking, Ghent University standards were applied. In this respect, the quality of the tutoring activities generally can be described as average to good since a score of 14 is equivalent to a 'distinction' degree at Ghent University.

Instruments

In line with the recommendations to apply multi-method designs when assessing SRL (Veenman, 2005; Winne & Perry, 2000), teacher ratings, off-line self-report questionnaires, and on-line think-aloud protocol analysis were combined. First, classroom teachers were asked to rate students' use of self-regulated learning strategies at the three measurement occasions. Second, all students completed the Children's Perceived use of Self-Regulated Learning Inventory (CP-SRLI) (Vandevelde, Van Keer, & Rosseel, 2013). Third, 41 students across conditions were randomly selected to individually perform a think-aloud task at each measurement occasion. The protocols of two participants were removed due to their reluctance to perform the tasks or to verbalise their thought processes during task performance. As such, think-aloud protocols of 19 control group students (9 fifth and 10 sixth graders; 7 boys and 12 girls) and 20 experimental group students (11 fifth and 10 sixth graders; 12 boys, 8 girls) were analysed. Both teacher ratings and students' self-report questionnaires collect quantitative information. By means of the think-aloud protocols qualitative data are gathered which were quantified afterwards, reflecting the occurrence of students' use of self-regulated learning strategies.

Teacher rating

The teacher rating instrument, developed for this study and in line with the strategies in the CP-SRLI (see further), comprises 19 items describing specific self-regulated learning strategies (example item: During task performance, the student monitors his/her comprehension). The items were scored on a five-point Likert-type scale ranging from never (1) to always (5). Cronbach's α were .96, .97, and .98 for pretest, posttest, and retention test respectively.

Off-line self-report questionnaire

All students completed the CP-SRLI (Vandevelde et al., 2013) at the three measurement occasions. The CP-SRLI consists of 15 subscales reflecting nine components of SRL (see Table 1) and assesses children's perceptions regarding their use of self-regulated learning strategies. As can be seen in Table 1, the internal consistency of the (sub)scales was acceptable to good, except for the subscale 'planning'. The 75 items were scored on a five-point Likert-type scale.

Table 1

Description of the subscales of the CP-SRLI and corresponding Cronbach's alpha's at pretest, posttest, and retention test

Subscale	Description	Example item	n_{items}	Cronbach's α Pretest	Cronbach's α Posttest	Cronbach's α Retention test
Task orientation	Analysing task demands, activation of prior (content/metacognitive) knowledge, perceptions of task (task difficulty, interest)	Before I start my schoolwork, I read the instructions carefully.	6	.70	.76	.78
Planning	Strategic planning, time planning	Before I start my schoolwork, I decide what to do first and what later.	4	.53	.58	.61
Motivation						
External regulation	External rewards and punishments	I do my best for school, because I am supposed to do so by others (my parents, the teacher, etc.).	3	.81	.83	.83
Introjected regulation	Internal rewards and punishments	I do my best for school, because I would feel guilty if I didn't do my best.	4	.72	.69	.72
Identified regulation	Personal importance, conscious valuing	I do my best for school, because I want to learn new things.	4	.80	.68	.79
Intrinsic regulation	Interest, enjoyment, inherent satisfaction	I do my best for school, because I find it very interesting.	3	.71	.69	.78
Self-efficacy						
Self-efficacy regulation	Judgements of capability to regulate learning	I'm good at planning the timing of my schoolwork before I start making it.	9	.80	.76	.78
Self-efficacy motivation	Judgements of capability to regulate motivation	I'm good at making my schoolwork, even if I find it boring or difficult.	4	.76	.68	.70
Learning strategies						
Deep-level strategies	Elaboration strategies, organisational strategies	When studying, I make a summary.	9	.84	.84	.84
Surface-level strategies	Rehearsal strategies	When studying, I copy everything until I know it by heart.	4	.75	.76	.75
Monitoring	Awareness and monitoring of cognition, motivation, behaviour and context/effort	During my schoolwork, I ask myself: 'Do I still understand everything?'	7	.71	.77	.73
Persistence	Persistence, concentration	Even if I would rather do other things, I finish my schoolwork.	6	.84	.83	.86
Motivational strategies	Self-reinforcement, positive self-talk, interest enhancement	During my schoolwork, I say to myself: 'Just a little more and it is finished!'	4	.62	.65	.65
Self-evaluation						
Product	Evaluation of the learning outcomes	After finishing my schoolwork, I check that I haven't forgotten anything.	3	.78	.79	.78
Process	Evaluation of the learning process, affective reactions	After finishing my schoolwork, I ask myself: 'Will I use a similar approach next time. Or should I choose a different approach?'	4	.79	.81	.81

On-line think-aloud protocol analysis

Think-aloud protocol analysis (TAPA) was used to assess and analyse students' actual and spontaneous use of self-regulated learning strategies. The think-aloud data complement the more general view of students' SRL obtained by the teacher ratings and the self-report questionnaire. The 39 participants individually performed a think-aloud task containing two different subtasks (i.e., Sudoku and text studying). Prior to task performance, participants received brief training in verbalising their thoughts, whereby the researcher modelled thinking-aloud followed by practice-opportunities (Caldwell & Leslie, 2010; Greene, Robertson, & Croker Costa, 2011; van Someren, Barnard, & Sandberg, 1994). The thinking-aloud sessions were audio- and videotaped.

Tasks

During the thinking-aloud session, the participants were asked to (1) solve a Sudoku, and (2) study an informative text in the same way as they usually do in preparing for a test. To increase the authenticity of the tasks, they were presented as homework assignments of their own classroom teachers. They were instructed to verbalise their thought processes, actions, and feelings concurrent to task execution. The researcher only interfered when the participant fell silent by prompting them to keep on thinking aloud. No time constraints or instructions regarding the order in which the tasks should be completed were given. In order to avoid both automated processes (occurring with unchallenging tasks) and cognitive overload (occurring with too complex tasks), attention was paid to the complexity of the tasks ensuring that the tasks were challenging yet comprehensible for students (Bannert & Mengelkamp, 2008; van Someren et al., 1994). Prior to administration, the comprehensibility and level of difficulty of the tasks was tested within one class. No adjustments were necessary.

During the Sudoku-task students had to solve a Sudoku. This task also contained a description of the three main rules of the game, illustrated by an example of a solved Sudoku. At pretest, a traditional Sudoku was used. At subsequent measurement occasions, variations were used (i.e., Puzzle Sudoku and X-Sudoku) to avoid familiarity with the tasks and to ensure the relevance for students to engage in analysing task instructions. The Sudoku's were of medium difficulty level (pretest: 27 empty fields, posttest: 28 empty fields; retention test: 29 empty fields).

The learning task comprised an informative text giving general background information regarding an animal (pretest: penguin, 434 words; posttest: barn owl, 486 words; retention test: seahorse, 487 words). Students had little or no prior knowledge regarding these subjects. At each measurement occasion, the informative texts consisted of five subtopics: general description, specific physical characteristics, feeding habits, predators and threats of extinction, and reproduction. Headings and subheadings further organised each text and contained several illustrations. Students were allowed, but not obligated to use a scratch paper for making notes.

Coding scheme

Based on a literature review and in line with the CP-SRLI conceptual framework (Vandevelde et al., 2013), the coding scheme for analysing the think-aloud protocols was developed. The coding scheme reflects ten main categories, each further specified by multiple subcategories. At the lowest operational level, specific indicators of self-regulated learning activities were formulated. Some of these activities reflected task-specific self-regulated learning activities either performed (1) during solving the Sudoku or (2) during text studying. Appendix B presents a detailed overview of the (sub)categories in the coding scheme.

Coding strategy

In total, 2 767 minutes of audio- and videotape were collected across the three measurement occasions. To increase the accuracy of coding, both verbal and non-verbal behaviour (e.g., highlighting key words, using scratch paper) was transcribed (Annevirta & Vauras, 2006) and coded qualitatively using the coding scheme. As a unit of analysis, we opted for units of meaning, defined as a unit representing a thematically consisted verbalisation of a single self-regulated learning strategy (Chi, 1997; van Someren et al., 1994). Each unit of meaning received only one code. When students performed a particular action successively, for example highlighting key words, these actions were not approached as one single segment, but as separate units. In this way, we were able to differentiate between students who only highlighted some keywords from those who used the strategy more extensively. In total, 1 609 units of meaning were identified at pretest, 1 907 units at posttest, and 2 036 units at retention test. Two trained coders independently double-coded 38% of the protocols, resulting in high inter-rater reliability for the main categories (Krippendorff's α = .97) and subcategories (Krippendorff's α = .96) of the coding scheme (Hayes & Krippendorff, 2007).

Data analysis

In order to investigate the first research question (i.e., investigating the initial state of SRL among students with a low socio-economic and/or immigrant background), descriptive analyses were performed on the teacher ratings, the CP-SRLI, and the occurrence of displayed strategies during the think-aloud tasks respectively.

As to the second (i.e., investigating the effectiveness of the student tutoring programme) and the third research question (i.e., presence of differential effects of students' motivational profile on the effectiveness of the student tutoring programme), first, the presence of different motivational profiles was examined by means of hierarchical cluster analysis in SPSS 20. The following CP-SRLI subscales scores at pretest were used as clustering variables: external regulation, introjected regulation, identified regulation, intrinsic motivation, self-efficacy motivation, and self-efficacy regulation. In hierarchical agglomerative clustering, each case starts out as a separate cluster and the closest cases are combined into a new aggregated cluster in subsequent steps. This process continues until all cases form a single homogeneous cluster. The Ward hierarchical method was adopted implying that within-cluster differences are minimized. The squared Euclidean was used as a similarity measure (Hair, Anderson, Tatham, & Black, 1998; Henry, Tolan, & Gorman-Smith, 2005). As the scale measurements were comparable for all variables, data were not standardised. To validate the number of clusters identified, a k-means cluster analysis was conducted on the same cluster variables (Gore, 2000; Henry et al., 2005). In addition, multivariate analysis of variance (MANOVA) was performed to test the differences between the motivational profiles on the variables included in the cluster analysis and the other subscales of CP-SRLI.

Second, to further study the effectiveness of the student tutoring intervention and the differential effects of students' motivational profile on the effectiveness of intervention, mixed ANOVA with condition (i.e., experimental and control group) and cluster memberships as between-subjects factors and measurement occasions (i.e., pre-, post-, and retention test) as within-subjects factor was used to analyse the questionnaire data (i.e., teacher ratings and students' self-report). When a significant interaction effect was shown, further analyses were performed to investigate this interaction more in depth and specific group means were compared by conducting linear hypothesising. Regarding the think-aloud data, the protocols were first coded qualitatively as described above. Next, the actual occurrence of self-regulated learning strategies at the different measurement occasions were analysed and compared quantitatively using two-way mixed ANOVA. As research stresses the domain-specificity of SRL (Veenman et al., 2006), the self-regulated learning activities performed during Sudoku and text studying were reported and analysed separately. Given the small sample size of students involved in the think-aloud protocols, the differential effects of the effectiveness of the intervention could not be studied.

Results

Students' SRL – Descriptive results

Teacher rating

According to the teacher judgments at pretest, students regulated their learning only on a moderate level (see Table 5). Remarkably, compared to the control condition, the teachers in the experimental condition rate their pupils' use of self-regulated learning strategies significantly lower at pretest ($F(1,359) = 19$, $p < .001$).

Self-report questionnaire

Descriptive analyses of the CP-SRLI data show that students report moderate to relatively high levels of self-regulated learning strategies at pretest (see Table 6). Regarding the subscales 'deep-level strategies' ($t = 2$, $df = 378$, $p = .046$) and 'surface-level strategies' ($t = 2.56$, $df = 378$, $p = .011$) the experimental group reported a significantly lower use than the control group.

Think-aloud protocols

The perceived use of self-regulated learning strategies was furthermore linked to students' actual use, reflected in the results of the think-aloud protocol analysis. Tables 2 and 3 present the occurrence of students' use of self-regulated learning strategies during solving the Sudoku and text studying respectively. First, regarding the metacognitive aspects of SRL across both tasks at pretest, the results show a predominant use of monitoring activities (26.3%), followed by adaptive strategy use (15.60%) across both tasks. In contrast, a limited use of task orientation (13.7%), planning (0.32%), and evaluation (4.84%) is shown at pretest. Based on the subcategories of the coding scheme a more detailed view arises showing that these metacognitive activities were performed on a rather basic level. For instance, activities regarding task orientation mainly reflect detecting task demands. However, in detecting task demands, students merely routinely read the task instructions without processing the demands thoroughly by, for example, paraphrasing the task instructions or activating prior knowledge. Further, the metacognitive activities, like task orientation, monitoring, and self-evaluation, were generally more frequently applied during the Sudoku than during text studying.

Concerning the cognitive learning strategies applied during text studying, students mostly demonstrate rehearsal (30%) and organisational strategies (27.11%). However, the occurrence of the strategies must be nuanced when inspecting the number of protocols showing these activities and the large variation between students. As such, it can be noticed that some strategies were performed by a limited number of students applying the strategies extensively.

Beside the metacognitive and cognitive aspects, the results of the think-aloud protocol analysis reveal limited motivational aspects of SRL. During task performance, students hardly ever reflected on their competence to perform the task (1.08%) or used motivational strategies to regulate their motivation (0.34%).

In conclusion, at the beginning of the intervention, the teacher ratings reveal that students regulated their learning only on a moderate level. The CP-SRLI data also show that students report moderate to relatively high levels of SRL. In-depth analysis of the pretest think-aloud data, however, indicates that students' self-regulated learning strategies were performed on a rather superficial level and varied considerably across students and tasks. Motivational aspects of SRL were hardly observed in the think-aloud data.

Cluster analysis

In order to explore the differential effects of student tutoring, the presence of different motivational profiles was explored using a hierarchical cluster analysis (N = 380). Relatively small changes in the agglomeration coefficients occurred until the four-cluster solution collapses into a three-cluster solution. Therefore, a four-cluster solution was chosen which was also confirmed by a visual inspection of the dendrogram. Based on an examination of the subscale means in each cluster (see Table 4 and Figure 1), four motivational profiles were identified: (a) a high quantity motivation and high self-efficacy cluster (HMS) with high scores on all cluster variables (*n* = 55; 14.5%), (b) a moderate quality motivation and moderate self-efficacy cluster (MMS) with high scores on identified regulation and moderate scores on self-efficacy for regulation and motivation (*n* = 197, 51.8%), (c) a low quantity motivation and self-efficacy cluster (LMS) characterised by low scores on all cluster variables (*n* = 29, 7.6%), and (d) a good quality motivation and high self-efficacy cluster (GMS) which has, comparable to HMS, high scores on identified regulation, intrinsic motivation, self-efficacy of regulation and self-efficacy motivation, but low scores on external and introjected regulation (*n* = 99; 26.1 %).

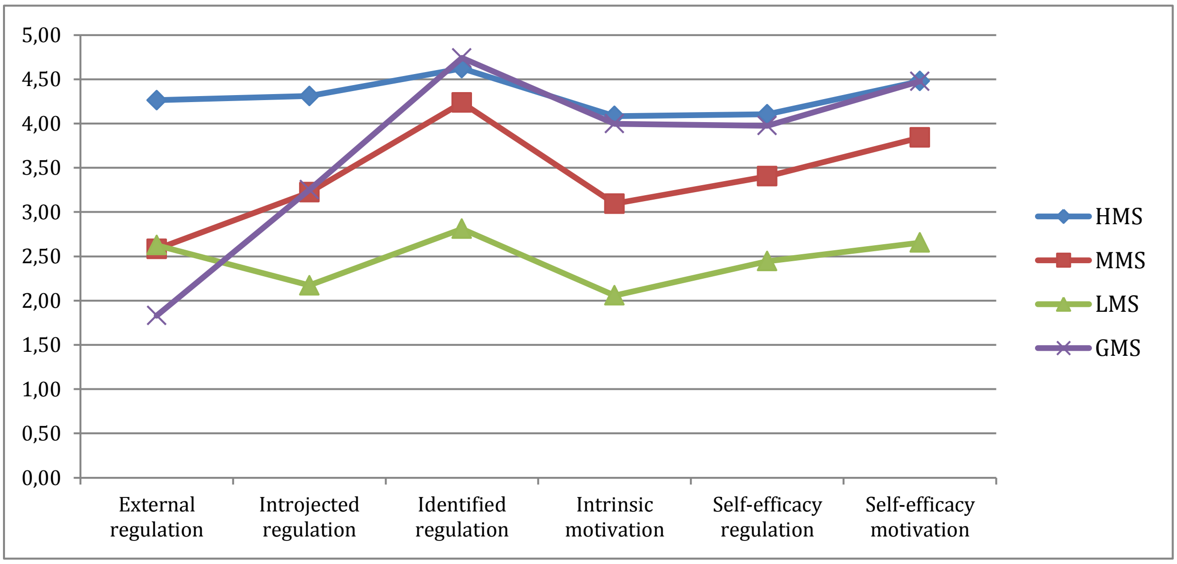

Figure 1. Mean scores of the four clusters on the cluster variables. *Note.* HMS = high levels of motivation and self-efficacy beliefs; MMS = moderate levels of autonomous motivation and self-efficacy beliefs; LMS = low levels of motivation and self-efficacy beliefs; GMS = high levels of autonomous motivation and self-efficacy beliefs.

The multivariate test of MANOVA (Wilks' lambda criterion) shows significant differences between the motivational profiles on the cluster variables as well as on the other subscales of CP-SRLI ($F(45,1067) = 21.86$; $p < .001$; partial $\eta^2 = 0.476$). The univariate tests also reveal significant differences for the clusters on external regulation ($F(3,373) = 94.39$; $p < .001$; partial $\eta^2 = 0.432$), introjected regulation ($F(3,373) = 44.79$; $p < .001$; partial $\eta^2 = 0.265$), identified regulation ($F(3,373) = 114.93$; $p < .001$; partial $\eta^2 = 0.480$), intrinsic regulation ($F(3,373) = 87.40$; $p < .001$; partial $\eta^2 = 0.413$), self-efficacy regulation ($F(3,373) = 90.34$; $p < .001$; partial $\eta^2 = 0.421$), self-efficacy motivation ($F(3,373) = 89.08$; $p < .001$; partial $\eta^2 = 0.417$), task orientation ($F(3,373) = 26.71$; $p < .001$; partial $\eta^2 = 0.177$), planning ($F(3,373) = 15.07$; $p < .001$; partial $\eta^2 = 0.108$), persistence ($F(3,373) = 32.82$; $p < .001$; partial $\eta^2 = 0.209$), monitoring ($F(3,373) = 34.45$; $p < .001$; partial $\eta^2 = 0.217$), motivational strategies ($F(3,373) = 30.17$; $p < .001$; partial $\eta^2 = 0.195$), deep-level strategies ($F(3,373) = 31.51$; $p < .001$; partial $\eta^2 = 0.202$), surface-level strategies ($F(3,373) = 19.85$; $p < .001$; partial $\eta^2 = 0.138$), self-evaluation product ($F(3,373) = 24.71$; $p < .001$; partial $\eta^2 = 0.166$), self-evaluation process ($F(3,373) = 33.73$; $p < .001$; partial $\eta^2 = 0.212$).

To validate the clusters identified in the hierarchical cluster analysis, a k-means cluster analysis was performed on the data, specifying a four-cluster solution. As shown in Table 4, the results suggested four similar profiles (22.6% HMS, 35.5% MMS, 10.8% LMS, 31.1% GMS). A comparison of hierarchical and k-means clustering, indicates that 73.95% of the cases were similarly classified, suggesting relatively robust cluster groups (Steele, Cushing, Bender, & Richards, 2008).

In sum, four motivational profiles can be distinguished in the student sample. The profiles can be described as: (a) a high quantity motivation group (i.e., high levels of motivation and self-efficacy beliefs; HMS); (b) a moderate quality motivation group (i.e., moderate levels of autonomous motivation and self-efficacy beliefs; MMS); (c) a low quantity motivation group (i.e., low levels of motivation and self-efficacy beliefs; LMS); and (d) a good quality motivation group (i.e., high levels of autonomous motivation and self-efficacy beliefs; GMS).

Table 4

Means of the clustering variables per cluster

	Hierarchical clustering				K-means clustering			
Cluster variables	Cluster 1 HMS (*n*=55)	Cluster 2 MMS (*n*=197)	Cluster 3 LMS (*n*=29)	Cluster 4 GMS (*n*=99)	Cluster 1 HMS (*n*=86)	Cluster 2 MMS (*n*=135)	Cluster 3 LMS (*n*=41)	Cluster 4 GMS (*n*=118)
External regulation	4.26	2.58	2.62	1.83	3.86	2.91	2.52	1.45
Introjected regulation	4.31	3.22	2.17	3.25	4.14	3.25	2.37	3.09
Identified regulation	4.62	4.24	2.81	4.74	4.63	4.26	3.03	4.59
Intrinsic regulation	4.08	3.10	2.06	4.00	4.18	3.04	2.06	3.69
Self-efficacy regulation	4.11	3.40	2.44	3.98	4.09	3.42	2.53	3.76
Self-efficacy motivation	4.48	3.84	2.66	4.48	4.40	3.84	2.87	4.31

Table 2

Occurrence of students' actual use of self-regulatory learning activities – Sudoku

Dependent variables	Pretest				Posttest				Retention test			
	CG		EG		CG		EG		CG		EG	
	Freq. (%)	*n* (Max.)[a]	Freq. (%)	*n* (Max.)[a]	Freq. (%)	*n* (Max.)[a]	Freq. (%)	*n* (Max.)[a]	Freq. (%)	*n* (Max.)[a]	Freq. (%).	*n* (Max.)[a]
Task orientation	68 (21.86)	19 (13)	85 (30.36)	19 (16)	56 (29.32)	19 (15)	40 (24.69)	17 (15)	56 (26.67)	17 (11)	51 (26.98)	17 (9)
Exploring the task	1 (0.32)	1 (1)	1 (0.36)	1 (1)	1 (0.52)	1 (1)	2 (1.23)	2 (1)	0 (0.00)	0 (0)	0 (0.00)	0 (0)
Detecting task demands	51 (16.40)	19 (11)	75 (26.79)	19 (14)	41 (21.47)	16 (14)	33 (20.37)	17 (3)	37 (17.62)	16 (6)	42 (22.22)	17 (9)
Prior knowledge	7 (2.25)	7 (1)	4 (1.43)	4 (1)	9 (4.71)	8 (2)	4 (2.47)	4 (1)	17 (8.10)	13 (4)	7 (3.70)	7 (1)
Task perceptions	8 (2.57)	5 (3)	5 (1.79)	3 (2)	5 (2.62)	5 (1)	1 (0.62)	1 (1)	2 (0.95)	2 (1)	2 (1.06)	1 (2)
Planning	1 (0.32)	1 (1)	0 (0.00)	0 (0)	2 (1.05)	18 (2)	2 (1.23)	2 (1)	0 (0.00)	0 (0)	2 (1.06)	2 (1)
Time management	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)
Strategic planning	1 (0.32)	1 (1)	0 (0.00)	0 (0)	2 (1.05)	1 (2)	2 (1.23)	2 (1)	0 (0.00)	0 (0)	2 (1.06)	2 (1)
Self-efficacy	4 (1.29)	3 (2)	7 (2.50)	5 (2)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	1 (0.16)	1 (1)	1 (0.53)	1 (1)
Motivational strategies	1 (0.32)	1 (1)	0 (0.00)	0 (0)	2 (1.05)	1 (2)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)
Positive self-talk	1 (0.32)	1 (1)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)
Making task more interesting	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)
Increasing task value	0 (0.00)	0 (0)	0 (0.00)	0 (0)	1 (0.52)	1 (1)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)
Self-reinforcement	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)
Monitoring	130 (41.80)	18 (38)	95 (33.93)	17 (15)	70 (36.65)	14 (15)	53 (32.72)	14 (9)	80 (38.10)	17 (12)	66 (34.92)	14 (13)
Comprehension monitoring	86 (27.65)	15 (25)	63 (22.50)	15 (13)	39 (20.42)	13 (6)	46 (28.40)	14 (7)	46 (21.90)	14 (9)	44 (23.28)	12 (8)
Monitoring of progress	20 (6.43)	15 (7)	5 (1.79)	5 (1)	16 (8.38)	10 (4)	2 (1.23)	2 (1)	12.(5.71)	5 (3)	12 (6.35)	4 (1)
Interim checking	12 (3.86)	5 (6)	11 (3.93)	6 (3)	10 (5.24)	4 (6)	3 (1.85)	2 (2)	13 (6.19)	5 (4)	0 (0.00)	0 (0)
Affective monitoring	12 (3.86)	7 (3)	16 (5.71)	4 (11)	5 (2.62)	3 (3)	2 (1.23)	2 (1)	9 (4.29)	4 (4)	10 (5.29)	4 (4)
Adaptive strategy use	87 (27.97)	16 (18)	69 (24.64)	17 (12)	51 (26.70)	14 (10)	59 (36.42)	15 (8)	65 (30.95)	17 (12)	59 (31.22)	14 (13)
Correcting mistakes	30 (9.65)	10 (10)	31 (11.07)	10 (6)	17 (8.90)	8 (3)	43 (26.54)	13 (7)	22 (10.48)	12 (6)	44 (23.28)	13 (10)
Selective navigation	30 (9.65)	7 (10)	17 (6.07)	8 (5)	16 (8.38)	7 (6)	8 (4.94)	6 (2)	29 (13.81)	7 (12)	6 (3.17)	3 (4)
Self-questioning	27 (8.68)	10 (8)	21 (7.50)	10 (6)	18 (9.42)	7 (8)	8 (4.94)	5 (4)	14 (6.67)	4 (8)	9 (4.76)	4 (3)
Self-evaluation	20 (6.43)	7 (14)	24 (8.57)	9 (5)	10 (5.24)	12 (3)	8 (4.94)	7 (2)	8 (3.81)	8 (1)	10 (5.29)	7 (3)
Learning outcomes	19 (6.11)	7 (13)	16 (5.71)	8 (5)	9 (4.71)	7 (3)	7 (4.32)	7 (1)	8 (3.81)	8 (1)	10 (5.29)	7 (3)
Learning processes	1 (0.32)	1 (1)	2 (0.71)	2 (1)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)
Affective reactions	0 (0.00)	0 (0)	6 (2.14)	3 (3)	1 (0.52)	1 (1)	1 (0.62)	1 (1)	0 (0.00)	0 (0)	0 (0.00)	0 (0)

Note. CG = control group, *n* = 19; EG = experimental group involving a student tutoring program focusing on SRL, n = 20.

[a] *n* refers to the number of protocols showing a particular activity and the maximum number of occurrence within *one* protocol.

Table 3

Occurrence of students' actual use of self-regulatory learning activities – Text studying

Dependent variables	Pretest				Posttest				Retention test			
	CG		EG		CG		EG		CG		EG	
	Freq. (%)	*n* (Max.)[a]	Freq. (%)	*n* (Max.)[a]	Freq. (%)	*n* (Max.)[a]	Freq. (%)	*n* (Max.)[a]	Freq. (%)	*n* (Max.)[a]	Freq. (%).	*n* (Max.)[a]
Task orientation	1 (0.19)	1 (1)	10 (2.62)	6 (3)	7 (1.01)	6 (2)	4 (0.58)	4 (1)	5 (0.78)	4 (2)	3 (0.36)	2 (2)
Exploring the task	1 (0.19)	1 (1)	4 (1.05)	3 (2)	3 (0.43)	3 (1)	3 (0.44)	3 (1)	2 (0.31)	2 (1)	0 (0.00)	0 (0)
Detecting task demands	0 (0.00)	0 (0)	3 (0.79)	3 (1)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)
Prior knowledge	0 (0.00)	0 (0)	1 (0.26)	1 (1)	3 (0.43)	3 (1)	1 (0.15)	1 (1)	2 (0.31)	2 (1)	2 (0.24)	2(1)
Task perceptions	0 (0.00)	0 (0)	2 (0.52)	2 (1)	1 (0.14)	1 (1)	0 (0.00)	0 (0)	1 (0.16)	1 (1)	1 (0.12)	1 (1)
Planning	2 (0.39)	1 (2)	6 (1.57)	3 (4)	7 (1.00)	4 (2)	14 (2.04)	8 (5)	5 (0.78)	4 (2)	2 (0.24)	2 (1)
Time management	0 (0.00)	0 (0)	0 (0,00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)
Strategic planning	2 (0.39)	1 (2)	6 (1.57)	3 (4)	7 (1.00)	4 (2)	14 (2.04)	8 (5)	5 (0.78)	4 (2)	2 (0.24)	2 (1)
Self-efficacy	0 (0.00)	0 (0)	1 (0.26)	1 (1)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)
Rehearsal strategies	256 (49.52)	14 (83)	40 (10.47)	13 (6)	109 (15.66)	12 (46)	60 (8.75)	12 (28)	145 (22.69)	13 (31)	41 (4.87)	12 (9)
(Re)reading	48 (9.28)	13 (15)	33 (8.64)	12 (6)	56 (8.02)	9 (24)	45 (6.56)	12 (14)	24 (3.76)	8 (8)	25 (2.97)	10 (6)
Memorizing	208 (40.23)	8 (82)	7 (1.83)	4 (3)	53 (7.59)	6 (22)	15 (2.19)	2 (14)	121 (18.94)	9 (30)	16 (1.90)	4 (6)
Organizational strategies	15 (2.90)	1 (15)	196 (51.31)	6 (70)	450 (64.66)	9 (95)	504 (73.47)	9 (152)	285 (44.60)	13 (45)	679 (80.64)	13 (149)
Structuring source text	3 (0.58)	1 (3)	117 (30.63)	4 (70)	244 (34.96)	7 (75)	193 (28.13)	6 (106)	169 (26.45)	7 (45)	248 (29.45)	6 (63)
Making notes	12 (2.32)	1 (12)	79 (20.68)	3 (40)	206 (29.51)	5 (86)	311 (45.34)	6 (110)	116 (18.15)	5 (45)	431 (51.19)	10 (125)
Elaboration strategies	117 (22.63)	17 (28)	50 (13.09)	14 (10)	89 (12.79)	13 (22)	44 (6.41)	9 (14)	101 (15.81)	16 (22)	53 (6.29)	10 (17)
Paraphrasing	35 (6.77)	9 (16)	26 (6.81)	9 (6)	52 (7.45)	10 (22)	30 (4.37)	7 (11)	41 (6.42)	11 (17)	38 (4.51)	6 (15)
Relating to prior knowledge	20 (3.87)	10 (5)	8 (2.09)	5 (4)	5 (0.72)	5 (2)	2 (0.29)	1 (2)	11 (1.72)	7 (3)	3 (0.36)	2 (1)
Relating text contents	21 (4.06)	6 (8)	7 (1.83)	5 (2)	6 (0.86)	6 (1)	6 (0.87)	5 (2)	0 (0.00)	0 (0)	2 (0.24)	2 (1)
Providing personal remarks	41 (7.93)	15 (7)	9 (2.36)	3 (4)	26 (3.72)	7 (9)	6 (0.87)	6 (5)	49 (7.67)	12 (12)	10 (1.19)	5 (3)
Motivational strategies	1 (0.19)	1 (1)	2 (0.52)	2 (1)	1 (0.14)	1 (1)	0 (0.00)	0 (0)	1 (0.16)	1 (1)	0 (0.00)	0 (0)
Positive self-talk	1 (0.19)	1 (1)	0 (0,00)	0 (0)	1 (0.14)	1 (1)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)
Making task more interesting	0 (0.00)	0 (0)	0 (0,00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)
Increasing task value	0 (0.00)	0 (0)	2 (0.52)	2 (1)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)
Self-reinforcement	0(0,00)	0 (0)	0 (0,00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	1 (0.16)	1 (1)	0 (0.00)	0 (0)
Monitoring	99 (19.15)	14 (22)	39 (10.21)	12 (14)	26 (3.74)	10 (10)	21 (3.06)	6 (7)	86 (13.46)	12 (26)	46 (5.46)	11 (11)
Comprehension monitoring	25 (4.84)	8 (6)	25 (6.54)	7 (13)	2 (0.29)	2 (1)	3 (0.44)	1 (3)	4 (0.63)	3 (2)	15 (1.78)	7 (7)
Monitoring of progress	5 (0.97)	5 (1)	1 (0.26)	1 (1)	13 (1.86)	4 (8)	5 (0.73)	3 (2)	6 (0.94)	5 (2)	13 (1.54)	6 (4)
Interim checking	65 (12.57)	8 (18)	10 (2.62)	6 (5)	8 (1.15)	6 (2)	9 (1.13)	3 (5)	74 (11.58)	8 (24)	18 (2.14)	5 (8)
Affective monitoring	4 (0.77)	1 (4)	3 (0.79)	2 (2)	2 (0.29)	3 (1)	4 (0.58)	3 (2)	2 (0.31)	2 (1)	0 (0.00)	0 (0)

Adaptive strategy use	16 (3.09)	5 (8)	28 (7.33)	5 (20)	2 (0.29)	2 (1)	30 (4.37)	5 (20)	2 (0.31)	2 (1)	11 (1.31)	7 (4)
Rereading after confusion	2 (0.39)	2 (1)	2 (0.52)	2 (1)	0 (0.00)	0 (0)	1 (0.15)	1 (1)	1 (0.16)	1 (1)	4 (0.48)	3 (2)
Correcting mistakes	7 (1.35)	2 (6)	18 (4.71)	2 (15)	0 (0.00)	0 (0)	2 (0.29)	2 (1)	0 (0.00)	0 (0)	4 (0.48)	4 (1)
Self-questioning	7 (1.35)	2 (5)	8 (2.09)	3 (4)	2 (0.29)	2 (1)	27 (3.94)	3 (19)	1 (0.16)	1 (1)	3 (0.36)	1 (3)
Self-evaluation	9 (1.74)	5 (3)	10 (2.62)	8 (2)	5 (0.72)	5 (1)	9 (1.31)	5 (3)	9 (1.41)	8 (2)	7 (0.83)	4 (4)
Learning outcomes	3 (0.58)	3 (1)	5 (1.31)	5 (1)	3 (0.43)	3 (1)	6 (0.87)	4 (2)	8 (1.25)	8 (1)	3 (0.36)	3 (1)
Learning processes	1 (0.19)	1 (1)	1 (0.26)	1 (1)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)	0 (0.00)	0 (0)
Affective reactions	5 (0.97)	3 (3)	4 (1.05)	4 (1)	2 (0.29)	2 (1)	3 (0.44)	3 (1)	1 (0.16)	1 (1)	4 (0.48)	1 (4)

Note. CG = control group, n = 19; EG = experimental group involving a student tutoring program focusing on SRL, n = 20.

[a] n refers to the number of protocols showing a particular activity and the maximum number of occurrence within *one* protocol.

Effectiveness of student tutoring programme on the evolution of students' SRL

Teacher rating

With respect to the effectiveness of the intervention, the results of the mixed ANOVA on the teacher ratings show a significant interaction of 'measurement occasion' and 'condition' ($F(2,232) = 9{,}97$, $p < .001$; see Table 5). As shown in Figure 2, the results indicate that, according to the teachers, students in the experimental group show significantly greater progress from pretest to posttest than control-group students ($F(1,249) = 16.16$, $p < .001$). However, the results also indicate a significant decrease for the experimental group from posttest to retention test compared to control-group students ($F(1,249) = 27.54$, $p < .001$).

Table 5

Results of the mixed ANOVA of teacher ratings

	Pretest		Posttest		Retention test	
	CG	EG	CG	EG	CG	EG
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
HMS	3.35 (0.61)	2.83 (0.60)	3.40 (0.61)	3.03 (0.68)	3.38 (0.81)	2.74 (0.69)
MMS	3.34 (0.68)	2.93 (0.58)	3.45 (0.63)	3.21 (0.73)	3.55 (0.68)	3.03 (0.85)
LMS	2.87 (0.73)	2.67 (0.97)	3.17 (0.45)	3.19 (0.94)	3.27 (0.54)	3.12 (0.93)
GMS	3.53 (0.64)	3.12 (0.69)	3.55 (0.72)	3.44 (0.80)	3.66 (0.68)	3.28 (0.78)
Total	3.36 (0.67)	2.93 (0.67)	3.44 (0.64)	3.24 (0.77)	3.53 (0.70)	3.06 (0.82)

Note. CG = control group; EG = experimental group involving a student tutoring program focusing on SRL; HMS = high levels of motivation and self-efficacy beliefs; MMS = moderate levels of autonomous motivation and self-efficacy beliefs; LMS = low levels of motivation and self-efficacy beliefs; GMS = high levels of autonomous motivation and self-efficacy beliefs.

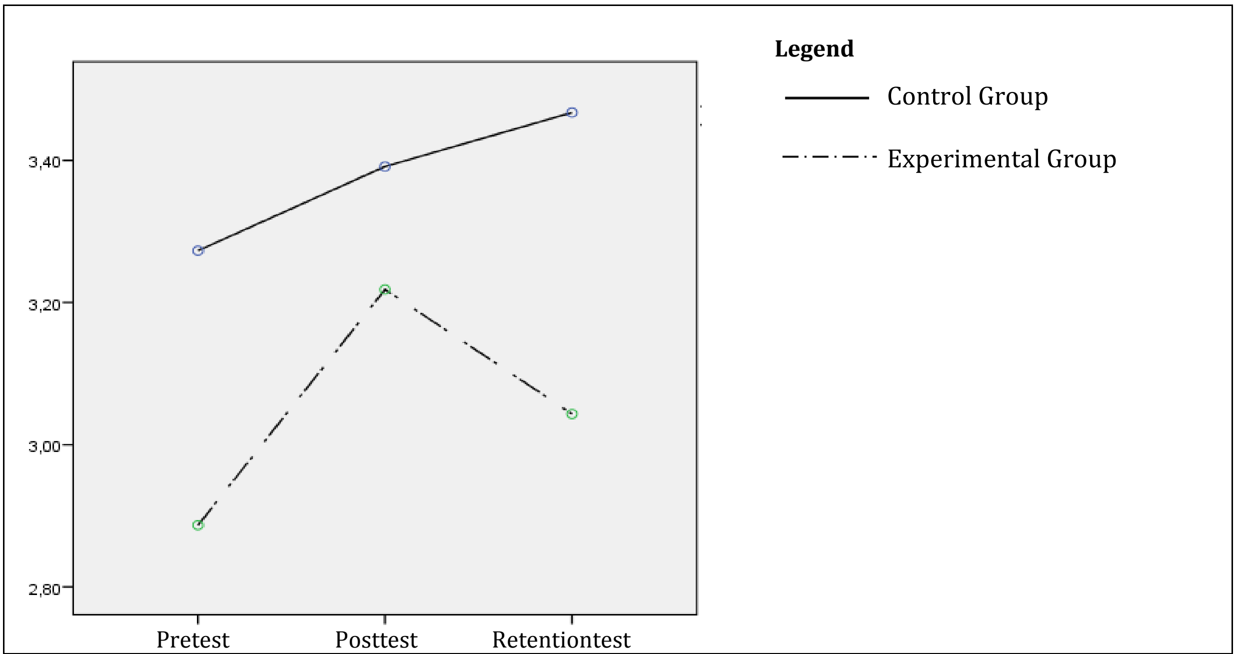

Figure 2. Evolution in students' SRL strategies as rated by the teachers.

The results of the mixed ANOVA on students' self-report data reveal only a significant interaction effect of 'measurement occasion' and 'condition' for the subscale 'external regulation' ($F(2,337) = 7.18$; $p < .001$; see Table 6). Further analyses reveal that this interaction effect only concerns the evolution from pretest to posttest, showing a significantly higher decrease for the control group compared to the experimental group ($F(3,337) = 20.31$; $p < .001$; see Figure 3). Regarding the other subscales, no significant trends could be observed in favour of the experimental group. Especially striking, however, are the large variations between individual change patterns from pretest to posttest and retention test. Figure 4, for example, shows students' individual change patterns on the subscale 'task orientation'.

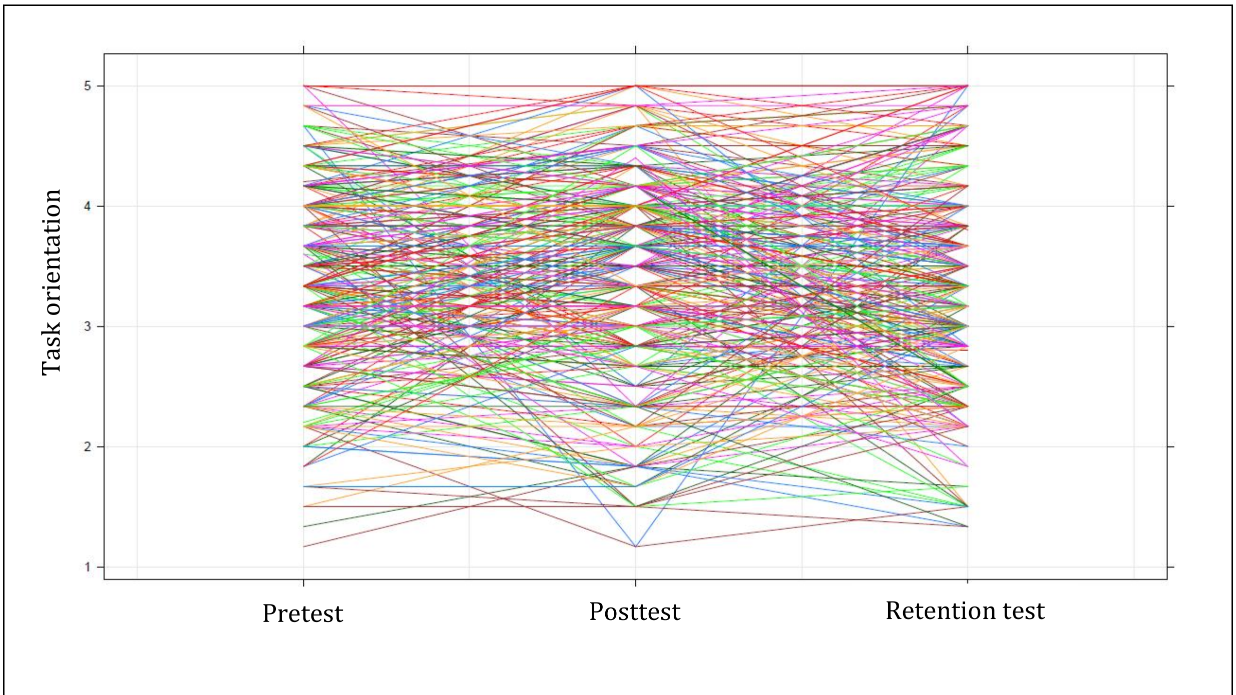

Figure 4. Individual patterns of evolution from pretest to posttest and retention test: Task orientation.

Table 6

Results of the mixed ANOVA of the CP-SRLI

Dependent variables	Pretest		Posttest		Retention test	
	CG	EG	CG	EG	CG	EG
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Task orientation						
HMS	3.81 (0.66)	3.51 (0.83)	3.98 (0.63)	4.05 (0.64)	3.56 (0.87)	3.73 (0.81)
MMS	3.30 (0.61)	3.23 (0.59)	3.30 (0.73)	3.32 (0.76)	3.24 (0.74)	3.18 (0.80)
LMS	2.44 (0.54)	2.81 (1.26)	2.55 (0.77)	2.93 (0.89)	2.52 (0.83)	3.00 (0.95)
GMS	3.64 (0.69)	3.68 (0.72)	3.54 (0.74)	3.73 (0.86)	3.42 (0.81)	3.61 (0.84)
Total	3.40 (0.71)	3.38 (0.77)	3.40 (0.79)	3.53 (0.84)	3.28 (0.81)	3.38 (0.86)
Planning						
HMS	3.71 (0.92)	3.43 (0.78)	3.86 (0.63)	3.61 (0.89)	3.84 (0.72)	3.14 (1.10)
MMS	3.24 (0.70)	3.14 (0.72)	3.38 (0.75)	3.29 (0.77)	3.32 (0.80)	3.43 (0.85)
LMS	2.58 (1.00)	2.96 (0.91)	3.08 (0.86)	2.57 (1.03)	2.84 (0.88)	3.68 (1.26)
GMS	3.65 (0.84)	3.54 (0.78)	3.55 (0.90)	3.53 (1.03)	3.75 (0.79)	3.46 (1.01)
Total	3.36 (0.83)	3.29 (0.78)	3.47 (0.80)	3.35 (0.92)	3.47 (0.83)	3.41 (0.97)
Motivation						
External regulation						
HMS	4.20 (0.49)	4.30 (0.58)	2.88 (1.27)	3.31 (1.02)	2.91 (1.30)	3.24 (1.16)
MMS	2.61 (0.88)	2.45 (0.85)	2.33 (0.97)	2.15 (1.07)	2.29 (1.01)	2.04 (0.99)
LMS	2.94 (1.31)	2.14 (0.86)	2.46 (1.17)	3.19 (1.07)	2.13 (0.72)	2.52 (1.18)
GMS	1.88 (0.86)	1.69 (0.73)	1.97 (1.00)	2.32 (1.11)	1.91 (1.11)	2.11 (1.00)
Total	2.66 (1.10)	2.50 (1.16)	2.32 (1.06)	2.48 (1.15)	2.27 (1.10)	2.30 (1.11)
Introjected regulation						
HMS	4.18 (0.55)	4.52 (0.49)	3.72 (0.76)	3.76 (0.79)	3.74 (0.87)	3.68 (0.98)
MMS	3.24 (0.74)	3.14 (0.75)	3.19 (0.85)	3.16 (0.92)	3.21 (0.83)	3.05 (0.99)
LMS	2.11 (0.77)	2.11 (0.59)	2.45 (0.97)	2.64 (0.91)	2.08 (0.91)	3.14 (1.61)
GMS	3.20 (1.12)	3.43 (1.08)	3.29 (1.12)	3.37 (0.94)	3.17 (1.10)	3.33 (0.95)
Total	3.29 (0.94)	3.37 (1.01)	3.24 (0.95)	3.28 (0.94)	3.20 (0.97)	3.25 (1.04)
Identified regulation						
HMS	4.61 (0.50)	4.55 (0.44)	4.60 (0.46)	4.32 (0.71)	4.61 (0.54)	4.34 (0.54)
MMS	4.28 (0.59)	4.15 (0.50)	4.29 (0.57)	4.37 (0.44)	4.19 (0.69)	4.22 (0.60)
LMS	2.78 (0.88)	3.00 (0.63)	3.49 (0.77)	3.82 (0.81)	3.25 (1.01)	4.14 (0.88)
GMS	4.75 (0.34)	4.73 (0.36)	4.64 (0.39)	4.66 (0.46)	4.58 (0.55)	4.58 (0.45)
Total	4.35 (0.71)	4.29 (0.65)	4.37 (0.60)	4.40 (0.57)	4.29 (0.73)	4.34 (0.59)
Intrinsic regulation						
HMS	4.10 (0.55)	3.83 (0.89)	4.05 (0.75)	3.67 (0.95)	3.91 (0.76)	3.21 (1.02)
MMS	3.05 (0.66)	3.25 (0.80)	3.30 (0.73)	3.29 (0.82)	3.06 (0.80)	3.16 (0.97)
LMS	1.96 (0.74)	1.86 (0.81)	2.31 (1.04)	2.43 (0.99)	1.96 (0.95)	3.38 (1.21)

GMS	3.98 (0.72)	4.01 (0.88)	3.77 (0.85)	3.65 (0.88)	3.81 (0.88)	3.69 (0.91)
Total	3.36 (0.89)	3.46 (1.02)	3.39 (0.89)	3.39 (0.92)	3.29 (0.97)	3.35 (0.99)
Self-efficacy						
Self-efficacy regulation						
HMS	4.10 (0.41)	4.11 (0.49)	4.06 (0.40)	3.79 (0.54)	3.73 (0.68)	3.63 (0.55)
MMS	3.43 (0.54)	3.35 (0.49)	3.46 (0.53)	3.48 (0.57)	3.40 (0.63)	3.22 (0.68)
LMS	2.58 (0.73)	2.44 (0.62)	2.69 (0.74)	3.23 (0.84)	2.67 (0.76)	3.25 (0.67)
GMS	3.93 (0.53)	4.08 (0.50)	3.78 (0.58)	3.64 (0.68)	3.69 (0.58)	3.68 (0.73)
Total	3.59 (0.65)	3.62 (0.70)	3.58 (0.62)	3.56 (0.63)	3.47 (0.68)	3.43 (0.70)
Self-efficacy motivation						
HMS	4.41 (0.50)	4.66 (0.41)	4.41 (0.54)	4.41 (0.41)	4.26 (0.64)	4.13 (0.47)
MMS	3.84 (0.64)	3.84 (0.61)	4.01 (0.63)	4.06 (0.57)	3.92 (0.63)	4.00 (0.64)
LMS	2.73 (0.64)	2.61 (0.83)	3.38 (0.95)	3.86 (0.76)	3.27 (0.84)	4.00 (1.23)
GMS	4.43 (0.57)	4.67 (0.41)	4.25 (0.63)	4.17 (0.88)	4.29 (0.49)	4.31 (0.57)
Total	4.00 (0.74)	4.12 (0.81)	4.08 (0.68)	4.14 (0.68)	4.02 (0.66)	4.11 (0.67)
Learning strategies						
Deep-level strategies						
HMS	3.88 (0.59)	3.49 (0.66)	3.83 (0.63)	3.87 (0.63)	3.45 (0.91)	3.55 (0.76)
MMS	3.27 (0.64)	3.01 (0.65)	3.29 (0.70)	3.04 (0.72)	3.19 (0.62)	3.03 (0.86)
LMS	2.60 (0.73)	2.36 (0.54)	2.73 (0.54)	2.70 (0.56)	2.64 (0.67)	2.77 (1.11)
GMS	3.68 (0.76)	3.53 (0.76)	3.59 (0.73)	3.44 (0.91)	3.52 (0.73)	3.25 (0.90)
Total	3.41 (0.74)	3.19 (0.75)	3.40 (0.73)	3.27 (0.83)	3.27 (0.73)	3.16 (0.89)
Surface-level strategies						
HMS	3.93 (0.91)	3.84 (0.73)	3.97 (0.83)	3.88 (1.09)	3.98 (0.87)	3.79 (1.14)
MMS	3.68 (0.71)	3.51 (0.74)	3.81 (0.77)	3.62 (0.68)	3.77 (0.72)	3.60 (0.82)
LMS	3.02 (0.83)	2.71 (1.02)	3.20 (0.78)	3.43 (0.79)	3.53 (0.78)	3.54 (0.73)
GMS	4.05 (0.82)	3.92 (0.91)	4.06 (0.75)	3.99 (0.88)	4.07 (0.77)	3.90 (0.85)
Total	3.77 (0.81)	3.62 (0.87)	3.86 (0.80)	3.76 (0.84)	3.86 (0.77)	3.71 (0.88)
Monitoring						
HMS	4.12 (0.67)	3.75 (0.71)	4.04 (0.62)	3.80 (0.81)	3.92 (0.81)	3.50 (0.71)
MMS	3.48 (0.57)	3.44 (0.58)	3.55 (0.60)	3.35 (0.79)	3.49 (0.62)	3.27 (0.74)
LMS	2.87 (0.56)	2.90 (0.73)	3.17 (0.59)	3.10 (0.89)	2.84 (0.86)	3.14 (0.97)
GMS	3.90 (0.61)	3.92 (0.71)	3.72 (0.82)	3.68 (0.92)	3.72 (0.67)	3.50 (0.76)
Total	3.63 (0.67)	3.59 (0.71)	3.63 (0.69)	3.50 (0.86)	3.56 (0.71)	3.37 (0.76)
Persistence						
HMS	4.46 (0.57)	4.64 (0.40)	4.38 (0.72)	4.61 (0.38)	4.43 (0.71)	4.15 (0.59)
MMS	4.10 (0.62)	4.03 (0.76)	4.08 (0.64)	4.21 (0.54)	4.00 (0.67)	4.16 (0.69)
LMS	3.39 (0.85)	3.55 (0.55)	3.35 (0.98)	3.90 (0.93)	3.45 (0.76)	4.48 (0.50)
GMS	4.52 (0.60)	4.70 (0.46)	4.40 (0.64)	4.44 (0.45)	4.32 (0.65)	4.51 (0.52)
Total	4.21 (0.68)	4.30 (0.72)	4.16 (0.72)	4.32 (0.56)	4.10 (0.72)	4.29 (0.63)

Motivational strategies						
HMS	4.14 (0.78)	4.21 (0.51)	4.21 (0.76)	3.82 (0.68)	4.04 (0.94)	3.79 (0.81)
MMS	3.59 (0.73)	3.57 (0.66)	3.72 (0.70)	3.55 (0.66)	3.58 (0.80)	3.60 (0.80)
LMS	3.02 (0.78)	2.75 (1.02)	3.05 (0.87)	3.07 (1.19)	3.17 (0.84)	3.29 (1.33)
GMS	4.07 (0.76)	4.06 (0.71)	4.00 (0.91)	3.94 (0.93)	3.82 (0.80)	3.91 (0.94)
Total	3.75 (0.81)	3.75 (0.79)	3.81 (0.82)	3.67 (0.83)	3.68 (0.84)	3.70 (0.90)
Self-evaluation						
Product						
HMS	4.34 (0.68)	4.38 (0.71)	4.43 (0.65)	4.26 (1.04)	4.30 (0.81)	4.29 (0.79)
MMS	3.89 (0.82)	3.48 (0.96)	3.86 (0.71)	3.74 (0.82)	3.78 (0.78)	3.68 (0.95)
LMS	3.06 (0.60)	2.71 (0.78)	3.31 (0.88)	3.48 (1.03)	3.48 (0.94)	3.66 (1.44)
GMS	4.16 (0.87)	4.06 (0.71)	4.21 (0.72)	4.19 (1.00)	3.98 (0.96)	4.21 (0.76)
Total	3.96 (0.85)	3.83 (1.05)	3.99 (0.77)	3.94 (0.96)	3.88 (0.86)	3.94 (0.95)
Process						
HMS	3.78 (0.94)	3.89 (0.70)	3.81 (0.99)	4.09 (0.89)	3.66 (1.00)	3.75 (0.73)
MMS	3.00 (0.87)	2.89 (1.01)	3.04 (0.99)	3.11 (1.02)	2.88 (0.95)	3.04 (1.03)
LMS	2.13 (0.84)	2.04 (0.82)	2.36 (0.76)	2.43 (1.52)	2.16 (0.92)	2.64 (1.59)
GMS	3.43 (0.93)	3.82 (0.84)	3.38 (1.03)	3.60 (0.92)	3.17 (1.11)	3.53 (1.07)
Total	3.16 (0.97)	3.26 (1.07)	3.19 (1.04)	3.36 (1.10)	3.01 (1.05)	3.27 (1.09)

Note. CG = control group; EG = experimental group involving a student tutoring program focusing on SRL; HMS = high levels of motivation and self-efficacy beliefs; MMS = moderate levels of autonomous motivation and self-efficacy beliefs; LMS = low levels of motivation and self-efficacy beliefs; GMS = high levels of autonomous motivation and self-efficacy beliefs.

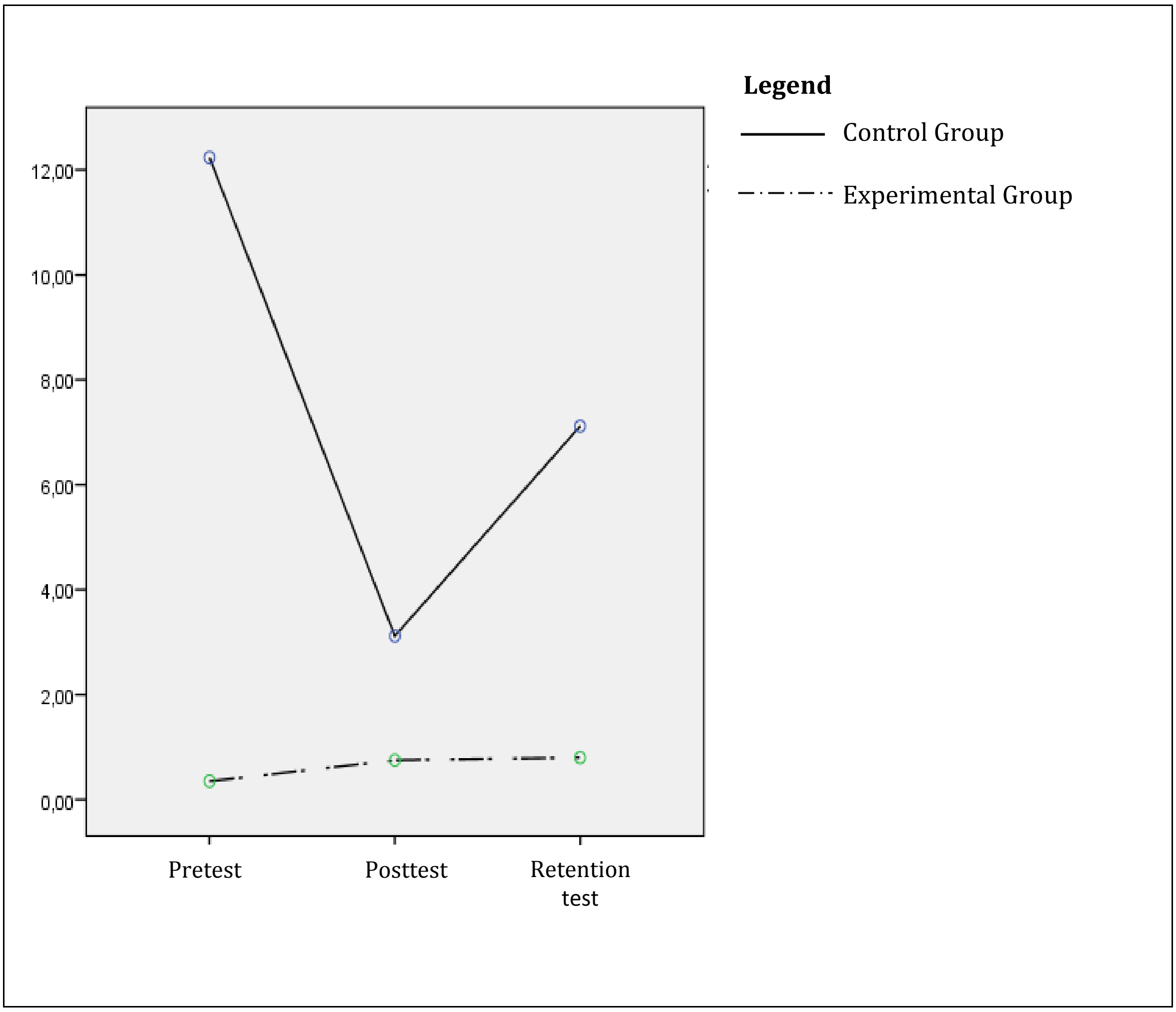

Figure 3. Evolution in students' self-reported use of SRL strategies: External regulation.

Think-aloud protocols

Based on the TAPA-data, the results of the mixed ANOVA reveal no significant differences between the experimental and the control condition regarding students' actual use of SRL while solving the Sudoku (see Table 7). During text studying, the only significant difference was found with respect to the subcategory 'memorising' (F(1,337)= 8.55; p < .001; see Table 8). Further analyses reveal only a significant difference between pretest and posttest scores showing that the control group decreases as compared to the experimental group (F(1,35) = 4.83, p = .035; see Figure 5).

In sum, teacher ratings show a significantly positive effect of the intervention from pretest to posttest. Based on the self-report data, however, only a significantly higher decrease from pretest to posttest for the control group was found regarding the subscale 'external regulation'. Based on the TAPA data, only a significant decrease for the control group regarding 'memorising' was found from pretest to posttest.

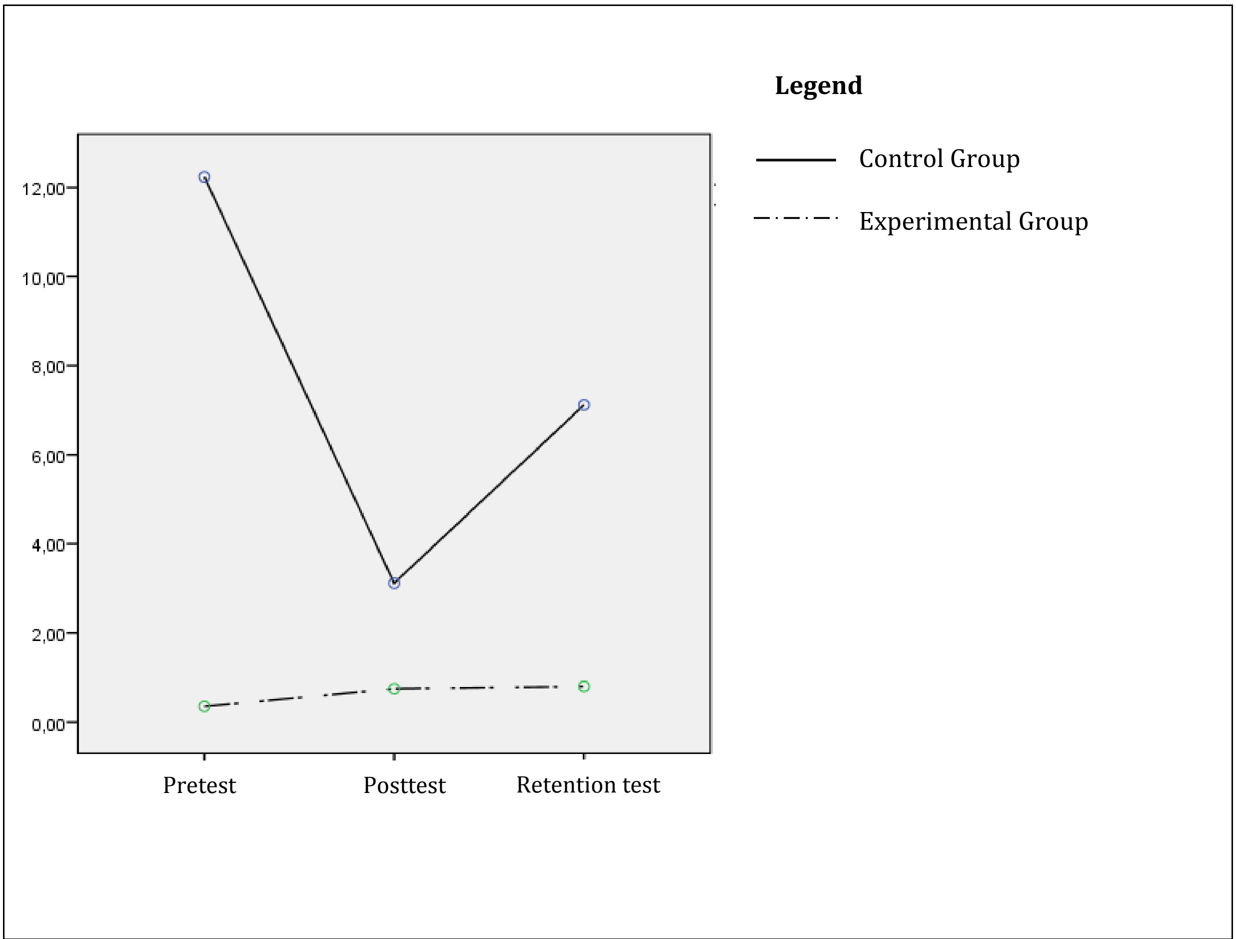

Figure 5. Evolution in students' self-actual use of SRL strategies: Memorising.

Table 7

Results of the mixed ANOVA of the think-aloud protocol analysis – Sudoku

Dependent variables	Pretest		Posttest		Retention test	
	CG	EG	CG	EG	CG	EG
	M[a] (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Task orientation	3.59 (2.81)	4.25 (4.54)	3.53 (3.10)	2.05 (1.23)	2.55 (3.01)	3.18 (2.70)
Exploring the task	0.00 (0.00)	0.05 (0.22)	0.06 (0.24)	0.10 (0.31)	0.00 (0.00)	0.00 (0.00)
Detecting task demands	2.82 (2.40)	3.75 (3.86)	2.64 (3.10)	1.70 (0.98)	2.06 (1.78)	2.10 (2.13)
Activation prior knowledge	0.29 (0.47)	0.20 (0.41)	0.53 (0.62)	0.20 (0.41)	1.00 (1.17)	0.35 (0.49)
Task perceptions	0.47 (0.87)	0.25 (0.64)	0.29 (0.47)	0.05 (0.22)	0.12 (0.33)	0.10 (045)
Planning	0.06 (0.24)	0.00 (0.00)	0.12 (0.49)	0.10 (0.31)	0.00 (0.00)	0.10 (0.31)
Time management	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Strategic planning	0.06 (0.24)	0.00 (0.00)	0.12 (0.49)	0.10 (0.31)	0.00 (0.00)	0.10 (0.31)
Self-efficacy	0.21 (0.54)	0.35 (0.67)	0.00 (0.00)	0.00 (0.00)	0.06 (0.24)	0.05 (0.22)
Monitoring	7.29 (9.30)	4.75 (5.00)	4.12 (4.03)	2.65 (2.64)	3.94 (3.77)	3.30 (3.44)
Comprehension monitoring	4.82 (7.01)	3.15 (3.73)	2.29 (2.17)	2.30 (2.38)	2.35 (2.62)	2.20 (2.57)
Monitoring of progress	1.18 (2.35)	0.25 (0.44)	0.94 (1.30)	0.10 (0.31)	0.53 (1.07)	0.60 (1.23)
Interim checking	0.71 (1.57)	0.55 (0.94)	0.59 (1.50)	0.15 (0.49)	0.00 (0.00)	0.00 (0.00)
Affective monitoring	0.59 (0.94)	0.80 (2.50)	0.29 (0.77)	0.10 (0.31)	0.53 (1.18)	0.50 (1.15)
Motivational strategies	0.59 (0.24)	0.00 (0.00)	0.12 (0.49)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Positive self-talk	0.06 (0.24)	0.00 (0.00)	0.06 (0.24)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Making task more interesting	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Increasing task value	0.00 (0.00)	0.00 (0.00)	0.06 (0.24)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Self-reinforcement	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Adaptive strategy use	3.65 (3.98)	3.45 (3.20)	3.00 (2.74)	2.95 (2.74)	3.47 (3.33)	2.95 (3.10)
Correcting mistakes	1.65 (2.91)	1.55 (2.04)	1.00 (1.22)	2.15 (2.37)	1.23 (1.60)	2.20 (2.53)
Selective navigation	1.18 (2.40)	0.85 (1.39)	0.68 (1.60)	0.40 (0.94)	1.41 (3.10)	0.30 (0.92)
Self-questioning	0.82 (1.07)	1.05 (1.61)	1.06 (2.01)	0.40 (0.94)	0.82 (2.10)	0.45 (0.94)
Self-evaluation	1.12 (3.35)	1.20 (1.74)	0.59 (0.87)	0.40 (0.60)	0.35 (0.49)	0.50 (0.83)
Learning outcomes	1.06 (3.11)	0.80 (1.32)	0.53 (0.80)	0.35 (0.49)	0.35 (0.49)	0.50 (0.83)
Learning processes	0.06 (0.24)	0.10 (0.31)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Affective reactions	0.00 (0.00)	0.30 (0.80)	0.06 (0.24)	0.05 (0.22)	0.00 (0.00)	0.00 (0.00)

Note. CG = control group; EG = experimental group involving a student tutoring program focusing on SRL.

[a] *M* refers to how often an individual student on average displayed a self-regulatory learning activity.

Table 8

Results of the mixed ANOVA of the think-aloud protocol analysis – Text studying

Dependent variables	Pretest		Posttest		Retention test	
	CG	EG	CG	EG	CG	EG
	M [a] *(SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Task orientation	0.06 (0.24)	0.50 (0.89)	0.41 (0.62)	0.20 (0.41)	0.00 (0.00)	0.00 (0.00)
Exploring the task	0.06 (0.24)	0.20 (0.52)	0.18 (0.39)	0.15 (0.37)	0.06 (0.24)	0.00 (0.00)
Detecting task demands	0.00 (0.00)	0.15 (0.37)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Activation prior knowledge	0.00 (0.00)	0.05 (0.22)	0.18 (0.39)	0.05 (0.22)	0.12 (0.33)	0.10 (0.31)
Task perceptions	0.00 (0.00)	0.10 (0.31)	0.06 (0.24)	0.00 (0.00)	0.06 (0.24)	0.05 (0.22)
Planning	0.12 (0.49)	0.30 (0.92)	0.41 (0.80)	0.70 (1.22)	0.29 (0.59)	0.10 (0.31)
Time management	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Strategic planning	0.12 (0.49)	0.30 (0.92)	0.41 (0.80)	0.70 (1.22)	0.29 (0.59)	0.10 (0.31)
Self-efficacy	0.00 (0.00)	0.50 (0.22)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Rehearsal strategies	15.00 (24.00)	2.00 (2.22)	6.41 (11.71)	3.00 (6.13)	8.24 (9.89)	2.05 (2.54)
(Re)reading	2.76 (4.19)	1.65 (1.95)	3.29 (6.11)	2.25 (3.26)	1.12 (2.12)	1.25 (1.68)
Memorising	12.24 (23.74)	0.35 (0.81)	3.12 (6.91)	0.75 (3.13)	7.12 (9.63)	0.80 (1.79)
Organisational strategies	0.88 (3.64)	9.80 (21.71)	26.47 (30.50)	25.20 (43.39)	13.76 (17.45)	33.95 (45.37)
Structuring source text	0.18 (0.73)	5.85 (17.66)	14.35 (21.60)	9.65 (24.62)	8.47 (15.36)	12.40 (21.63)
Making notes	0.71 (2.91)	3.95 (10.45)	12.12 (24.99)	15.50 (30.81)	5.29 (12.59)	21.55 (34.79)
Elaboration strategies	6.29 (7.29)	2.50 (2.74)	5.24 (5.91)	2.20 (4.06)	5.53 (6.46)	2.65 (4.51)
Paraphrasing	2.00 (3.86)	1.30 (2.00)	3.06 (5.58)	1.50 (2.96)	2.24 (4.19)	1.90 (4.19)
Relating to prior knowledge	0.94 (1.48)	0.40 (0.94)	0.29 (0.69)	0.10 (0.45)	0.47 (0.80)	0.15 (0.49)
Relating text contents	1.24 (2.61)	0.35 (0.67)	0.35 (0.49)	0.30 (0.57)	0.00 (0.00)	0.10 (0.31)
Providing personal remarks	2.12 (2.03)	0.45 (1.23)	1.53 (2.65)	0.30 (1.13)	2.82 (3.59)	0.50 (1.00)
Motivational strategies	0.06 (0.24)	0.10 (0.31)	0.06 (0.24)	0.00 (0.00)	0.06 (0.24)	0.00 (0.00)
Positive self-talk	0.06 (0.24)	0.00 (0.00)	0.06 (0.24)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Making task more interesting	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Increasing task value	0.00 (0.00)	0.10 (0.31)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Self-reinforcement	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.06 (0.24)	0.00 (0.00)
Monitoring	5.71 (7.41)	1.95 (3.24)	1.53 (2.48)	1.05 (2.19)	4.82 (7.90)	2.30 (3.20)
Comprehension monitoring	1.35 (2.12)	1.25 (2.98)	0.12 (0.33)	0.15 (0.67)	0.24 (0.56)	0.75 (1.62)
Monitoring of progress	0.29 (0.47)	0.05 (0.22)	0.76 (1.98)	0.25 (0.64)	0.18 (0.39)	0.65 (1.27)
Interim checking	3.82 (6.15)	0.50 (1.15)	0.47 (0.72)	0.45 (1.28)	4.29 (7.59)	0.90 (2.17)
Affective monitoring	0.24 (0.97)	0.15 (0.49)	0.18 (0.39)	0.20 (0.52)	0.12 (0.33)	0.00 (0.00)
Adaptive strategy use	0.88 (2.21)	1.40 (4.47)	0.12 (0.33)	1.50 (4.63)	0.12 (0.33)	0.55 (1.00)
Rereading after confusion	0.06 (0.24)	0.10 (0.31)	0.00 (0.00)	0.05 (0.22)	0.06 (0.24)	0.20 (0.52)
Correcting mistakes	0.41 (1.46)	0.90 (3.39)	1.00 (1.22)	2.15 (2.37)	0.00 (0.00)	0.20 (0.41)
Self-questioning	0.41 (1.28)	0.40 (0.99)	0.12 (0.33)	1.35 (4.44)	0.06 (0.24)	0.15 (0.67)
Self-evaluation	0.29 (0.77)	0.50 (0.69)	0.29 (0.47)	0.45 (0.83)	0.53 (0.62)	0.35 (0.93)
Learning outcomes	0.18 (0.39)	0.25 (0.44)	0.18 (0.39)	0.30 (0.66)	0.47 (0.51)	0.15 (0.37)
Learning processes	0.06 (0.24)	0.05 (0.22)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Affective reactions	0.06 (0.24)	0.20 (0.41)	0.12 (0.33)	0.15 (0.37)	0.06 (0.24)	0.20 (0.89)

Note. CG = control group; EG = experimental group involving a student tutoring program focusing on SRL. [a] *M* refers to how often an individual student on average displayed a self-regulatory learning activity.

Relation of students' motivational profiles with responsiveness to the intervention

Teacher rating

In order to study whether the effectiveness of the intervention varies according to students' motivational profile, the interaction of 'measurement occasion', 'condition', and 'cluster membership' was studied in the mixed ANOVA for the teacher ratings and self-reported use of SRL. With respect to the teacher rating, no significant interaction of 'measurement occasion', 'condition', and 'cluster membership' was found (see Table 5).

Self-report questionnaire

With regard to the CP-SRLI data (see Table 6), the results show a significant interaction effect for the following subscales: planning (F(6, 672)= 3.43; p = .002), intrinsic motivation (F(6, 672)= 3.41; p = .003), self-efficacy regulation (F(6, 672)= 3.24; p = .004), and persistence (F(6, 672)= 3.17; p = .005). Regarding 'planning', further analyses show a significantly different progress for experimental versus control-group students with an LMS profile (see Figure 6). More specifically, compared to the control group, a decrease for the experimental group from pretest to posttest (F(1,337)= 5,24; p = .023) can be seen, but an increase is noted from posttest to retention test (F(1,337)= 12.88; p < .001). From pretest to retention test no significant difference was found between students from both conditions with an LMS profile (F(1,337)= 1.24; p = .266). Also concerning 'intrinsic motivation' the results indicate a differential effect for students with an LMS profile, showing a significant difference between both conditions from posttest to retention test (F(1,337)= 13.85; p < .001) and from pretest to retention test (F(1,337)= 12.87; p < .001) in favour of the experimental group (see Figure 6). With respect to 'self-efficacy regulation', the results indicate a positive evolution for the LMS students in the experimental group from pretest to posttest (F(1, 337)= 7.29; p = .007) and from pretest to retention test (F(1,337)= 6.28; p = .013) (see Figure 6). In contrast, a decrease from pretest to posttest is observed for the GMS experimental students (F(1, 337)= 4.98; p = .026) (see Figure 6). With respect to 'persistence', the analyses show a significant difference between the conditions for students with an HMS profile. More specifically, the experimental group show a decrease from posttest to retention test (F(1, 337)= 5.78; p = .017) and from pretest to retention test (F(1,337)= 4.81; p = .029) (see Figure 6). Also for students with an LMS profile, differences in the evolution in 'persistence' between both conditions can be detected, namely a positive evolution from pretest to retention test for the experimental group (F(1,337)= 8.55; p = .004; see Figure 6).

Concluding, based on the teacher ratings no relationship was found between students' motivational profiles and their responsiveness to the intervention. Based on the self-report data, however, differential effects were found regarding 'planning', 'intrinsic motivation', 'self-efficacy regulation', and 'persistence'. Students in the experimental condition with an LMS profile more particularly show a significant (a) decrease from pretest to posttest regarding 'planning'; (b) increase from posttest to retention test regarding 'planning'; (c) increase from posttest to retention test and from pretest to retention test regarding 'intrinsic motivation'; (d) increase from pretest to posttest and from pretest to retention test regarding 'self-efficacy regulation', and (e) increase from pretest to retention test regarding 'persistence'. Students in the experimental condition with a GMS profile show a significant decrease from pretest to posttest regarding 'self-efficacy regulation'. Students in the experimental condition with an HMS profile display a decrease with respect to 'persistence' from posttest to retention test and from pretest to retention test.

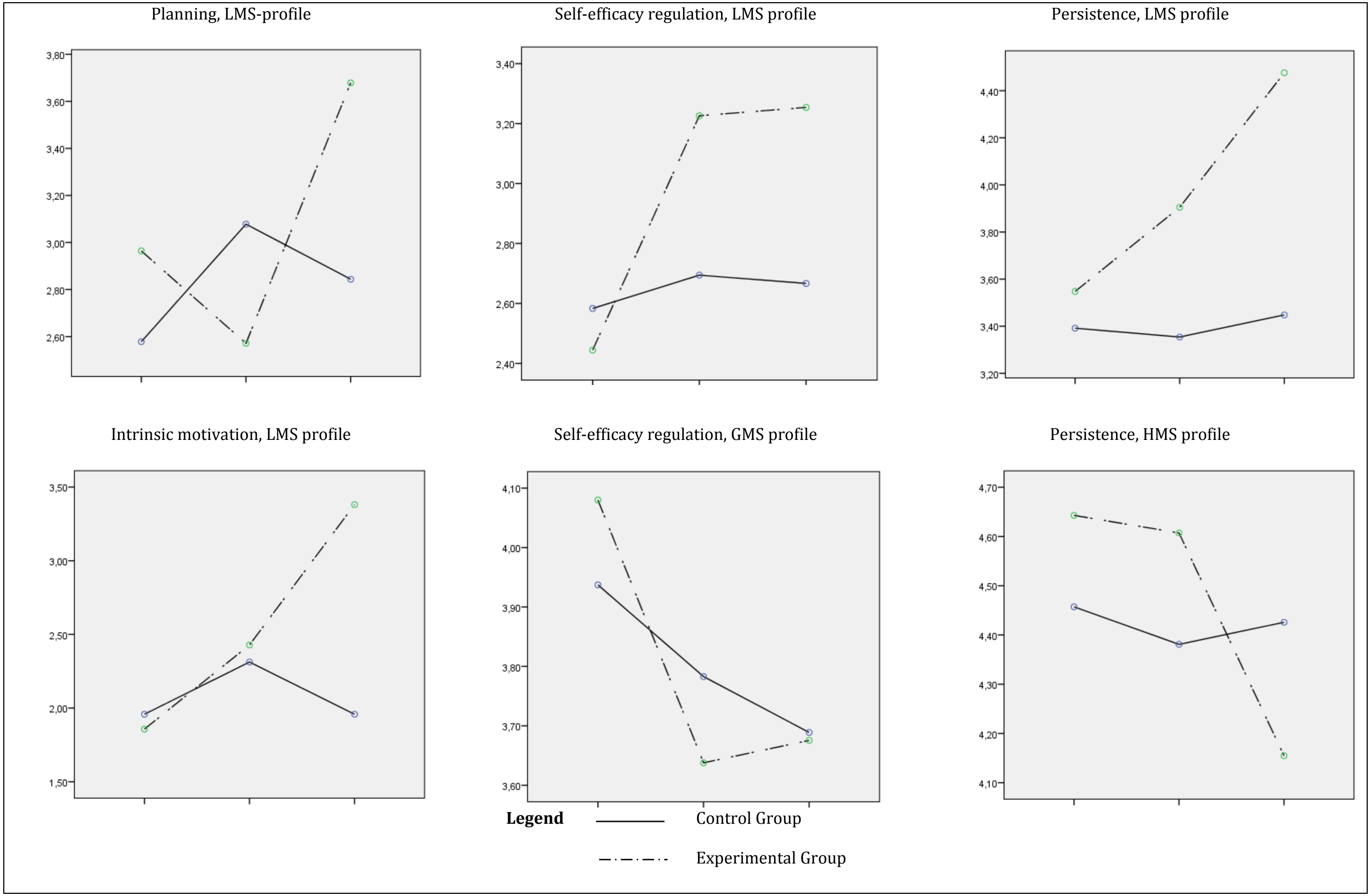

Figure 6. Interaction measurement occasion x condition x cluster: planning, intrinsic motivation, self-efficacy regulation, and persistence.

Discussion

Students' ability to actively engage during learning, for example by means of setting appropriate goals, maintaining motivation, accurately monitoring learning, and adjusting the use of strategies, are critical competencies that should be a central and explicit aim in education. Despite the importance of these self-regulated learning activities and the call for promoting SRL early in students' school career (Perry et al., 2004; Veenman & Spaans, 2005), primary school teachers stimulate SRL only to a limited extent (Hamman et al., 2000; Lombaerts, Engels, & Vanderfaeillie, 2007; Zimmerman, 2002). Especially students from more disadvantaged backgrounds seem to struggle with regulating their learning effectively (Boekaerts, Pintrich, & Zeidner, 2000; Zimmerman, 2002). This study particularly aimed to describe socio-economically disadvantaged and immigrant students' SRL and to explore the effectiveness of student tutoring as an innovative approach to stimulate SRL among these late primary school students. Fifth and sixth graders were tutored in small groups by master students during 10 successive weeks. A quasi-experimental study with a pretest, posttest, and retention test control group design was used, combining teacher ratings, self-report questionnaires, and think-aloud protocol analysis to assess children's (evolution in) SRL. Further, it was investigated whether students' motivational profiles related to their responsiveness to the intervention. Below, the results of the present study are discussed in conjunction with suggestions for future research.

Initial state of students' SRL

The descriptive results of the present study fit in with prior studies evidencing that young children are capable of performing self-regulated learning behaviour (e.g., Perry et al., 2004; Whitebread et al., 2009). More specifically, the CP-SRLI data portrayed the most optimistic view as students report moderate to relatively high levels of self-regulated learning strategies at the beginning of the intervention. However, these results should be nuanced based on the results of the teacher ratings and especially the think-aloud data. The descriptive analyses of the teacher ratings revealed that the students regulated their learning only on a moderate level. In-depth analysis of the pretest think-aloud protocols indicates that the strategies were performed on a rather basic level, and were not yet sophisticated and academically oriented. Furthermore, strategy application largely varies between students and some self-regulated learning activities were rarely (e.g., motivational aspects of SRL) or never observed (e.g., time planning and time monitoring). The discrepancy between the self-report and the think-aloud data confirms the tendency of students to overestimate their actual strategy use in self-reports (Boekaerts & Corno, 2005; Cromley & Azevedo, 2006; Schellings & van Hout-Wolters, 2011; Veenman, 2011a). However, the value of self-report data should be acknowledged as well, as it provides insight into self-perceived propensities of using a particular tactic or strategy (Vandevelde et al., 2013; Perry & Winne, 2006; Pintrich, 2004; Richardson, 2004; Zimmerman, 2008). As students monitor their learning in relation to these personal perceptions of their learning approach and its outcomes (Winne & Jamieson-Noel, 2002), misinterpretations of SRL (i.e., overestimation) can result in persistent use of inadequate strategies, as they will not experience the need for more productive forms of SRL (Winne, 2004). This also implies a suggestion for the design of further training programmes, and in this case student tutoring programmes, namely confronting students' perceptions and beliefs about their self-regulated learning practices with their actual self-regulated learning behaviour at the beginning of the intervention (Credé & Phillips, 2011; Pajares & Valiante, 2002; Perry & Rahim, 2011; Turner & Patrick, 2008).

In conclusion, the descriptive findings confirm that children from low socio-economic and/or immigrant families encounter difficulties regulating their learning purposefully and profoundly and that additional support is needed to become more effective learners (Dembo & Eaton, 2000; Weinstein et al., 2000). Regarding the assessment of SRL, the study corroborates that by using a multi-method approach, one can profit from the power of different methods to obtain a broader picture and deeper insights into learners' self-regulated learning strategies.

Effectiveness of a student tutoring programme on the evolution of students' SRL

In line with previous research on SRL interventions (Dignath et al. 2008; Perels et al., 2005; Stoeger & Ziegler, 2008), the present results of the teacher ratings show a positive effect of the intervention from pretest to posttest. However, this positive effect was not maintained in the long term, confirming that struggling learners, as our target group, have difficulty maintaining and generalising learned skills and strategies (Graham, Harris, & Mason, 2005). These results also indicate that long-term support will be necessary to effect meaningful changes in SRL among these students.

Moreover, the results of students' self-report and think-aloud data generally reveal no significant positive effects of student tutoring on students' SRL. Based on these results one could conclude that student tutoring is not an effective approach to promote SRL among primary school children with low socio-economic and/or immigrant backgrounds. However, we would like to address some hypotheses to more fully interpret the current results and to provide input for further research regarding this topic.

First, as to the effectiveness of student tutoring interventions in general, it is difficult to compare the current results with previous findings as prior student tutoring interventions did not specifically focus on SRL. Prior research reveals that student tutoring interventions addressing low-level skills (e.g., computational skills in math) have been found to be more effective than interventions addressing the development of higher-level skills (e.g., reading comprehension; Gordon et al., 2007) and that long-lasting effects are not a matter of course (Slavin, Lake, Davis, & Madden, 2011). In this respect, the current results illustrate that student tutoring is not that promising to stimulate higher-level skills, like SRL.

Second, it might be possible that experimental condition students have acquired sufficient and increased metacognitive knowledge and skills, but do not yet perform them spontaneously (i.e., production deficiency), possibly due to a lack of motivation or a lack of a sense of necessity to perform these more demanding strategies (e.g., Veenman et al., 2006; Zimmerman, 2001). As to the latter, the present results indeed indicate that students might not have felt the necessity to adjust their learning behaviour, as they claim to self-regulate their learning already on a rather high level, while the think-aloud data showed a rather superficial strategy use. However, further investigation is required to confirm this hypothesis. Moreover, Zimmerman and Schunk (2001) suggest that the benefits of self-regulatory training efforts in primary school may not lead to immediate results and only become evident during middle-school years and thereafter. In this respect, it can be hypothesised that the effects of student tutoring may become evident later on when students are confronted with more demanding learning environments and experience that their current repertoire of SRL is insufficient. This brings up the issue regarding the 'critical' period to stimulate SRL. On the one hand, researchers stress the importance of fostering SRL already during primary education rather than waiting until secondary education in order to prevent children from developing ineffective learning habits (Dignath et al., 2008; Perry et al., 2004; Postholm, 2010; Stoeger & Ziegler, 2011). On the other hand, however, primary school children are less confronted with complex tasks and demanding learning environments. Consequently, they seem to experience the benefits and necessity of applying effective self-regulated learning strategies and to adjust their learning behaviour to a lesser extent. Exploring the effects over a longer period (i.e., following students in their transition to secondary school) and replicating this study design with secondary students could shed light on this matter.

Third, besides the age of the target group in the present study, their specific background characteristics also have to be taken into account when discussing the study findings. We must recognise the multiple sources (i.e., child and family characteristics, sociocultural factors, and schooling factors) influencing the academic trajectories of children with a low socio-economic and/or immigrant background, while during the intervention the main focus was solely on schooling factors. For these students, it may be necessary to consider the broader family and sociocultural context in the intervention as well to obtain sustained effects (McClelland, Acock, & Morrison, 2006). Comparing the current intervention with an intervention taking into account the broader family and sociocultural context might be a valuable approach for future research design. Further, some studies indicate that disadvantaged student populations can benefit from innovative and learner-centred learning environments (such as student tutoring) in terms of both academic and self-regulatory outcomes (Salinas & Garr, 2009). However, other studies state that students from a low socio-economic status and ethnic minority seem to benefit more from traditional learning environments (Hopkins & Reynolds, 2001). Hornstra (2013), for example, found that ethnic minority students showed less investment in school when the learning context relied more on self-regulation of their learning process. For these students it may be more difficult to find a suitable balance between transferring responsibility to the student, while still providing an optimal level of guidance (Hornstra, 2013). Further research could compare the effectiveness of student tutoring initiatives for students at-risk due to their low socio-economic status or ethnic minority background with comparable initiatives for students with a middle to high socio-economic status and native background.

Fourth, although important preconditions were taken into account to ensure qualitative student tutoring processes and training of SRL, some additional suggestions might be formulated for further research. In line with the recommendations in the literature, the (meta)cognitive and motivational components of SRL were simultaneously trained and practised (e.g., Dignath et al., 2008; Schunk & Ertmer, 2000) across multiple disciplinary domains (e.g., Kron-Sperl, Schneider, & Hasselhorn, 2008). Although there was an alternation between modelling, explicit instruction, and hands-on practice, it is possible that the intervention was too brief to address all targeted learning strategies profoundly and to provide sufficient practice and experiences regarding the multiple strategies. As suggested above, longer and more intensive interventions are needed in order to ensure that primary school students incorporate the instructed learning strategies into their learning repertoire.

However, the success of a student tutoring programme may depend as much or even more on the selection, training, and supervision of tutors as it does on the design of session contents (Vadasy et al., 1997). Even though studies show that under specific conditions positive effects can be obtained with minimally trained tutors (Fitzgerald, 2001; Karsenty, 2010; Morris, 2006), one cannot underestimate the degree of pedagogical knowledge required to guide a small group of vulnerable learners due to their low socio-economic and/or immigrant background, especially when tutoring focuses on complex and multi-faceted skills, such as SRL. Notwithstanding the fact that the tutors in the current study had a background in educational sciences, and received prior training and ongoing support, they may have encountered difficulties in encouraging sophisticated SRL among their tutees (Graesser & McNamara, 2010). Although the observations of the sessions revealed that the quality of tutoring was rather good, a closer analysis of the behaviour of effective student tutors and the ongoing tutor-tutee interaction, will be interesting to identify their qualities and the instructional practices that enable student tutors to create a positive and powerful learning environment (Cobb & Allen, 2001). This type of research should not only focus on generic tutoring skills (Chi, Siler, Jeong, Yamauchi, & Hausmann, 2001; Graesser, Person, & Magliano, 1995), but also on specific skills to promote SRL within small-group instruction. This information will also provide valuable input to optimise tutor training and ongoing support. Additionally, future research could also, explore the differential effects of tutor training by comparing the effects of student tutoring programmes in which tutors received (1) training regarding general tutoring skills only and (2) training on both general tutoring skills and activities promoting SRL, and compare those conditions to a control group, like in the current study.

In the current study design, student tutoring occurred in small-group settings. As it is plausible that learning effects for tutees can not only result from support and interaction with the tutor, but also from interaction with the other tutees, further research can also take into account tutees' interaction to investigate whether this provides supplementary learning opportunities in addition to the support of the tutors (i.e., by comparing the current experimental condition with a condition implementing a one-on-one training on SRL.)

Finally, it should be noted that in the current think-aloud protocol analysis only the occurrence of SRL strategies was analysed. For example, we could only investigate whether students highlighted key words more frequently after the intervention, but not whether they highlighted more relevant keywords. In further research, a more profound analysis could be performed in which not only the quantity or the degree of occurrence is considered, but also the quality of the performed strategies. As such, trace methodology could be combined with think-aloud protocol analysis (Winne, 2010). Another methodological limitation is the considerable drop-out of teacher ratings from the control group as not all of them completed the questionnaire on the subsequent measurement occasions. Although teacher ratings are considered to provide valuable additional information on children's SRL (Desoete, 2008; Winne & Perry, 2000), a considerable group of teachers reported not to feel competent in providing these judgments.

Relation of students' motivational profiles with responsiveness to the intervention

As the present results indicate remarkably large inter-individual differences, it is likely that the results at group level are not fully representative for individual gains. Hence, adapting a person-centred approach and studying individual patterns of change may yield quite different results than focusing on general group trends (Kron-Sperl et al., 2008). In this respect, the present study also investigated whether the effectiveness of student tutoring varied according to students' specific motivational profiles which is a unique approach within this research field. Comparable to previous studies (Ratelle, Guay, Vallerand, Larose, & Senecal, 2007; Vansteenkiste et al., 2009), we found four different motivational profiles (i.e., high quantity, moderate quality, low quantity, and good quality motivation groups). This person-centred approach is valuable as researchers indicate that students combine different motives in a relatively unique way (Vansteenkiste et al., 2009) and that learning behaviour can be the result of a combination of several motives (Pintrich, 2003).

When considering the results of the differential effectiveness of student tutoring in promoting SRL, the picture becomes more complex. For students with an HMS and GMS profile, a negative effect was found regarding persistence and self-efficacy regulation respectively. In contrast, students with an LMS profile, which can be considered as most at-risk due to their low levels of motivation and self-efficacy beliefs, seem to profit the most from the intervention compared to the other groups. This is a promising finding, as these students rated their strategy use as very low at the beginning of the intervention. Due to their participation in the student tutoring programme, these students become more intrinsically motivated, have more confidence in their ability to regulate their learning, and show a higher persistence in engaging in school tasks. As research shows that intrinsic motivation and self-efficacy have a positive effect on the use of cognitive and metacognitive strategies (Pintrich, 2000), this is a positive outcome. These results confirm the importance of considering students' motivational profile when designing interventions and indicate that the affective component of student tutoring might be a powerful stepping stone for important motivational concepts regarding SRL as the current differential effects were mainly found regarding motivational aspects of SRL. Notwithstanding the positive outcome that the present student tutoring programme could empower the most vulnerable motivational group, future research should explore how the student tutoring design can be optimised in order to be beneficial for a larger group of students. As such, this study confirms the adherence to evidence-based practice and rigorous evaluations testing the effectiveness of student tutoring programmes (Ritter et al., 2009). Further research can play an important role in comparing methods of implementation, analysing success and failure in different applications of student tutoring, and effectively communicating these findings back to educational research and practice in order to guide the development of new initiatives. Further, given the complexity of SRL, we believe that the alignment between student tutoring initiatives and the classroom practice can be fruitful (Wasik, 1998) so that tutors can be complementary in providing more individualised help and that teachers can provide additional support to facilitate the maintenance of the effects of student tutoring programmes. In this respect and in line with the response to the intervention-approach, in which all children receive the general curriculum and then a subset of children identified as at-risk receive supplemental tiers of instruction (small groups or one-on-one) (Fuchs & Vaughn, 2012), further research can, for example, explore whether student tutoring is an adequate method to provide additional and more intensive guidance to students who did not respond to classroom instruction regarding SRL.

Conclusion

This study provides an innovative scope within the research field of SRL by investigating the effectiveness of student tutoring on the SRL among fifth and sixth graders who are at-risk for school failure due to their socio-economic and/or immigrant background. In doing so, this study provides more insight into the emerging research area studying primary school students' SRL, and more specifically SRL among students with low socio-economic and/or immigrant backgrounds, which is currently an underexposed research area. This study points out that SRL strategy acquisition among these children is more complex and variable than originally assumed and that – unfortunately – student tutoring as a method to promote SRL among these children did not fully meet expectations. In line with Slavin et al. (2011), the current results create caution for the expectation that a relatively brief, small-group student tutoring intervention can have the power to put all students with low socio economic and/or immigrant backgrounds permanently on track. This does not necessarily imply that focusing on SRL cannot be effective for these students. Therefore, further research should elaborate on the most effective ways to do so. In our view, there will be no one panacea to stimulate complex and multi-faceted skills like SRL among socio-economically disadvantaged and immigrant students. Instead, high-quality and continuous support combining different kinds of promotion tailored to the specific needs and profiles of the students will be needed to obtain lasting effects.

In this respect, we have advocated and made suggestions for further research in order to gain more insight into substantial conditions and factors influencing the effectiveness of student tutoring programmes promoting higher-level skills, like SRL, on the one hand. On the other hand, it is important to consider how, for whom, and to what extent student tutoring can be complementary to daily class practice in order to realise the promotion of SRL in primary education. Regarding the latter, the present results indicate that student tutoring is particularly beneficial to empower low-motivated learners regarding motivational aspects of SRL, but further research will be needed to verify these results. The current study sought to understand how SRL among students with low socio-economic and/or immigrant backgrounds can be promoted by means of a student tutoring programme. However, future research is recommended to further unravel this complex matter.

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Appendix A

Overview of the intervention content[a]

Session	Content	SRL component[b]	Example of activities
1	Self-reflection on one's own learning	Metacognitive and motivational component	Identifying personal strengths and weaknesses in study behaviour
2	SRL cyclical phases: use of forethought, performance control, and self-reflection processes. Operationalised as: task definition; goal setting and planning; execution of the task and monitoring; global evaluation	Metacognitive component	Performing an activity according to a step-by-step plan
3	Goal setting, time-management, environmental structuring	Metacognitive component	Estimating duration of a task and comparison with actual time-use
4	Activating prior knowledge, text comprehension, asking questions	Cognitive component	Predicting the content of a text by scanning
5	Distinguishing main issues from side-issues, structuring texts through indicating keywords	Cognitive component	Highlighting key words in text
6	Representing texts schematically through mind mapping	Cognitive component	Making a mind map of a text
7	Memorising techniques	Cognitive component	Practising mnemonics techniques
8 +9[c]	Preparing an oral presentation about a self-selected theme (integrating and applying the learned self-regulatory strategies)[b]	Motivational metacognitive and cognitive component	
10	Oral presentation		

Note: [a] Compared with the intervention in de pilot study, two adjustments were made: (1) the key SRL strategies (e.g., task orientation, planning, monitoring) were concretised by means of metaphors regarding professions (e.g., planning was symbolised as 'architect') to make the strategies more comprehensible for the young age group, and (2) based on the previous implementation of the student tutoring programme, the manual for tutors was extended with additional information regarding potential difficulties tutees might face and possible approaches to tackle these difficulties.
[b] The different components of SRL are explicitly addressed during particular sessions. Moreover, the metacognitive and motivational component are integrated throughout all sessions. Regarding the motivational component, it is expected that the affective processes during tutoring (e.g., trusting relationship with a tutor, modelling of enthusiasm, receiving more praise) will foster important motivational aspects (Topping & Ehly, 2001). Therefore, the motivational component is not explicitly addressed during a particular session, but is embedded in the process of tutoring throughout all sessions.
[c] Following the statement of Perry et al. (2004) that complex tasks are effective forms promoting SRL, the last two sessions were reserved for a complex assignment, namely preparing an oral presentation about a self-selected theme giving the students the opportunity to integrate and apply the learned self-regulated strategies. As the sixth graders had already participated in the student tutoring programme during the previous school year, they started with this assignment in session 4

Appendix B

Categories of the coding scheme for think-aloud protocols

Main coding categories	Subcategories	Specific indicators
FORETHOUGHT AND PLANNING PHASE		
Task orientation	Exploring the task subject and constitution	Global document screening
	Detecting task demands	Reading the instructions[a]
		Rereading the instructions before commencing on the task[a]
		Paraphrasing task instructions
		Examining and discussing the Sudoku-example[a]
		Asking for additional information before commencing on the task
		Rereading the instructions after commencing on the task[a]
	Activation prior knowledge	Activating prior content knowledge
		Activating prior metacognitive knowledge
	Becoming aware of one's task perceptions	Reflecting on task difficulty
		Reflecting on task interest and/or value
Planning	Time management	Making a time schedule/allocating time
	Strategic planning	Depicting how to approach the task
Self-efficacy	Reflecting on their competence to perform the task	
PERFORMANCE PHASE		
Rehearsal strategies[b]	(Re)reading[b, c]	Rereading the source text[b]
		Scanning and generating hypotheses[b]
		(Re)reading one's own notes[b]
	Memorising[b]	Rereading for memorising[b]
		Copying source text[b]
		Reciting source text[b]
		Reciting one's own notes[b]
Organisational strategies[b]	Structuring text[b]	Highlighting key words during first-time reading of source text[b]
		Highlighting key words during subsequent reading of source text[b]
		Structuring one's own notes[b]
	Making notes[b]	Noting key words or key sentences during first time text reading[b]
		Noting key words or key sentences during subsequent text reading[b]
		Making a summary during first time text reading[b]
		Making a summary during subsequent text reading[b]
		Making a graphical summary during first-time text reading[b]
		Making a graphical summary during subsequent text reading[b]

Elaboration strategies[b]	Paraphrasing text content[b]	
	Relating text content to prior knowledge[b]	
	Relating text contents[b]	
	Providing personal remarks to the text content[b]	
Motivational strategies	Positive self-talk	
	Making task more interesting	
	Increasing task value	
	Self-reinforcement by promising themselves rewards	
Monitoring	Comprehension monitoring	Noting lack of comprehension
		Noting understanding
	Monitoring of progress	Reflecting on the progress made
		Reflecting on the available time and time schedule
		Reflecting on the quality of the strategy use
	Interim checking	Quickly checking source text during reciting[b]
		Interim checking of correctness or completeness of task performance
	Affective monitoring	Reflecting on task difficulty
		Reflecting on one's self-efficacy
		Reflecting on task interest and/or value
Adaptive strategy use	Rereading source text after confusion[b]	
	Correcting errors	
	Selective navigation during solving the Sudoku[a]	
	Self-questioning to support one's learning process	
REACTION AND REFLECTION PHASE		
Self-evaluation	Evaluating learning outcomes after task performance	Checking completeness of task performance
		Checking correctness of solution
		Recapitulating task instructions
		Scanning source text to check memorisation[b]
	Evaluating learning processes after task performance	
	Affective reactions	Reflecting on task difficulty
		Reflecting on self-efficacy
		Reflection on task interest or value
Off-task behaviour		Asking practical questions, looking outside, etc.

Note [a] Sudoku-specific behaviour. [b] Text studying-specific behaviour

[c] First time text reading before performing subsequent learning activities was not incorporated into the analysis, but all students read the study text at least once.

6 Studying tutoring processes during student tutoring focusing on self-regulated learning by means of video analysis

This chapter is based on:

Vandevelde, S., Van Keer, H., De Backer, L., Van Steenbrugge, H., & Mertens, C. (2015). Unravelling tutoring processes during student tutoring focusing on self-regulated learning. Manuscript submitted for publication in *Cognition and Instruction*.

Chapter 6
Studying tutoring processes during student tutoring focusing on self-regulated learning by means of video analysis

Abstract

This study focuses on an underexplored topic within the research field of tutoring, namely studying tutoring processes during student tutoring focusing on self-regulated learning (SRL). During a 10 week student tutoring programme, three tutoring groups were studied in depth. Tutoring sessions were organised during school hours in small groups of two or three tutees per tutor. By means of video-analysis (1 071 minutes of video data) and multiple stages of coding, tutor and tutee interactions were studied as well as the shift in self-regulatory ownership across different tutoring sessions. Results show that the tutoring processes were mainly characterised by an interaction-centred approach. More concretely, tutor and tutees contributed almost equally to the dialogue, with the tutors mainly engaging in questioning and facilitation and the tutees in explaining. This supports the notion that tutees have more opportunities to participate as active participants in a student tutoring setting. However, tutor questioning and tutee explanations were rather shallow and mainly focused on strategy knowledge. Although some actions towards self-regulation were observed, a clear transition from external regulation to self-regulation was not found, and co-regulation mainly dominated the tutoring process already from the onset of the tutoring sessions. Notwithstanding the fact that current results underpin some of the premises of student tutoring, it also shows that tutors and tutees do not fully utilise the opportunities of student tutoring. By documenting the student tutoring process, this study not only deepens our understanding regarding the effectiveness of student tutoring and provides suggestions for further research in this matter, but also provides guidelines for tutor training.

Introduction

Tutoring is a widely applied instructional method, and numerous studies have witnessed its effectiveness across different student populations, domains, and formats (Bloom, 1984; Cohen, Kulik, & Kulik, 1982; Graesser, D'Mello, & Cade, 2011; Roscoe & Chi, 2007). Despite the widespread use in practice, student tutoring is a less known and studied format of tutoring. Student tutoring refers to "the practice of having students from universities and colleges tutor pupils in primary and high school classrooms under the guidance of the class teacher" (Topping & Hill, 1995, p.15). Although student tutors are not professional tutors or regular school teachers, the student tutor is the more capable, knowledgeable, and experienced student with a supportive role, while tutees are less experienced pupils receiving help (Topping & Hill, 1995). Like other formats of tutoring (Topping & Ehly, 2001), student tutoring programmes can vary according to a number of dimensions: tutee characteristics (e.g., learning delayed, socio-economically disadvantaged), tutor characteristics (e.g., community volunteers, pre-service teachers), curriculum (e.g., reading, mathematics), contact arrangements (e.g., one-to-one, small groups), and time (e.g., during class time, after school) (Gordon, Morgan, O'Malley, & Ponticell, 2007; Topping & Hill, 1995).

Although outcomes vary according to the particular design of the student tutoring programme, research generally shows positive outcomes for both tutees and tutors on the cognitive, affective, and social levels (Cohen et al., 1982; Gordon et al., 2007; Ritter, Barnett, Denny, & Albin, 2009; Topping & Hill, 1995). However, the magnitude of effects varies considerably (Gordon et al., 2007; Ritter et al., 2009), raising the question of which factors underlie the (variability in) effectiveness. One approach to address this issue is to unravel the tutoring processes (Graesser et al., 2011; Roscoe & Chi, 2007). However, the interest in process data has grown only in recent decades (Lepper & Woolverton, 2002; Roscoe & Chi, 2007; VanLehn, Siler, Murray, Yamauchi, & Baggett, 2003). This study builds further on this trend not only by shedding light on the strategies and actions adopted by tutors and tutees, but also by exploring the sequences of actions. Moreover, this study entails a student tutoring programme focusing on self-regulated learning (SRL) as curriculum of tutoring, which is an underexplored focus within tutoring research. In this respect, it was also explored how self-regulatory ownership evolves over time.

Tutoring processes

The prevailing notion is that tutoring effectiveness derives from the correct and appropriate application of tutors' pedagogical skills (Chi, Siler, Jeong, Yamauchi, & Hausmann, 2001). In this respect, Graesser, Person, and Magliano (1995) uncovered a typical tutorial dialogue comprised of five broad steps (i.e., 'five-step tutoring frame'): (1) the tutor asks a question or presents a problem; (2) the tutee gives an initial answer; (3) the tutor gives short feedback on the quality of the answer; (4) the tutor and tutee have a multi-turn dialogue to improve the answer; and (5) the tutor assesses the tutee's understanding of the answer. Whereas the first three steps are also frequently adopted in classroom dialogue patterns, the two additional steps, and especially the fourth step, are typical and perhaps the most salient characteristic of tutoring (Graesser et al., 1995; Graesser, Wiemer-Hastings, Wiemer-Hastings, & Kreuz, 1999; VanLehn, 2011). The fourth step more practically reflects a scaffolding episode (Chi et al., 2001).

Scaffolding, or providing support within tutees' zone of proximal development, is considered one of the tutors' main responsibilities (Cade, Copeland, Person, & D'Mello, 2008; Chi, Roy, & Hausmann, 2008; VanLehn, 2011). Successful scaffolding is characterised by an interactive process, the presence of a shared understanding of the activity, calibrated support based on an ongoing diagnosis of the students' knowledge and skills, and contingent fading to gradually transfer the responsibility for learning towards the tutee (Puntambekar & Hübscher, 2005; van de Pol, Volman, & Beishuizen, 2010).

Tutors can use different strategies to implement calibrated support (e.g., modelling, giving feedback, hinting, instructing, explaining, and questioning), with questioning as one of the most prevalent strategies (Chi et al., 2001; Graesser et al., 1995; Hadwin, Wozney, & Pontin, 2005; Roscoe & Chi, 2007; van de Pol et al., 2010). Tutors can ask a variety of question types, such as knowledge-review questions to activate prior knowledge or to introduce topics, comprehension-gauging questions to assess tutees' understanding, and metacognitive questions to prompt self-monitoring of learning. Tutors can also ask probing questions by requesting to expand on an idea or use questions to provide subtle hints (King, 1997; Roscoe & Chi, 2007). Besides questioning, tutors will also engage in explaining (Berghmans, Neckebroeck, Dochy, & Struyven, 2013; Roscoe & Chi, 2008). Ideally, tutors will keep lengthy explanations to a minimum and will seek to draw as much as possible from the tutee, and provide just-in-time instruction when the tutee is struggling (Cade et al., 2008; Graesser & McNamara, 2010; Lepper & Woolverton, 2002). Further, as reflected in the tutoring frame, a tutor will provide feedback on the correctness of answers or knowledge throughout a session (Chi, Siler, & Jeong, 2004; Merrill, Reiser, Merrill, & Landes, 1995). Lepper and Woolverton (2002) found that expert tutors provide feedback in a more indirect way instead of giving direct corrective feedback. In the face of an incorrect answer or problem step, good tutors are likely to pose a question so that the tutees themselves reconsider or change their ideas or task approach.

Only the cognitive components of tutoring have been discussed above, but effective tutors are concerned simultaneously with tutees' learning on the one hand, and their motivation and emotions on the other hand (Gordon et al., 2007; Graesser & McNamara, 2010). Effective tutors are highly supportive by being continuously attentive to their tutees, empathising with tutees' difficulties, rousing tutees' sense of curiosity, showing confidence in tutees' ability to succeed, and taking time to converse with the tutees about their interests in and outside of school (Graesser & McNamara, 2010; Lepper & Woolverton, 2002; Topping & Ehly, 2001).

Taking into account the complex spectrum of activities tutors are expected to master and perform, studies show that less experienced tutors do not always fully exploit the opportunities of tutoring and struggle to provide high qualitative and individualised support. For example, less experienced tutors encounter difficulties in adopting sophisticated pedagogical techniques, such as modelling-scaffolding-fading, often dominate the dialogues, are prone to knowledge-telling explanations with little elaboration or construction of knowledge, and tend to ask more questions about facts or definitions than questions requiring deeper reasoning and reflection. Further, less experienced tutors are limited in accurately assessing and diagnosing tutees' understanding or knowledge, complicating adaptive support and feedback, and they have a strong tendency to follow curriculum scripts instead of selecting tasks tailored to the specific needs of the tutees (Berghmans et al., 2013; Chi et al., 2008; Chi et al., 2004; Chi et al., 2001; Graesser, D'Mello, & Person, 2009; Graesser et al., 1995; Merrill et al., 1995; Roscoe & Chi, 2007; Roscoe & Chi, 2008).

Although these results portray a less optimistic view of tutors' pedagogical skills, studies also illustrated that some untrained tutors did manage to spontaneously adopt high quality activities (Roscoe and Chi, 2007), and evaluations of tutoring programmes have shown effectiveness even when the tutors were unskilled or minimally trained (Fitzgerald, 2001; Karsenty, 2010; Morris, 2006). Thus, the notion that tutoring effectiveness does not only arise from tutors' pedagogical skills receives more grounding in recent studies. In this respect, it is argued that tutoring might be effective because it affords students greater opportunities to engage more actively in constructive learning, such as asking questions or engaging in self-explanations, compared to traditional classrooms (Chi et al., 2001; Graesser et al., 1999). However, research suggests that characteristics of student-centred tutoring (e.g., selecting topics and problems, actively working on solutions, asking questions) are rarely observed in tutoring situations (Graesser & McNamara, 2010). This approach is hampered by, for example, the fact that students are not very good at calibrating their comprehension, find it difficult to set their own agendas, rarely take the initiative to ask questions or merely ask unsophisticated questions (Chi et al., 2001; Graesser & Person, 1994; Graesser et al., 1995; Roscoe & Chi, 2007). More recently, the interactive nature and the joint collaborative efforts of both tutors and tutees is stressed to further explain the effectiveness of tutoring (Chi et al., 2008; Chi et al., 2001; Graesser et al., 2011). In this respect, current studies increasingly underline the importance of not only considering tutor moves, but also how tutees elicit and respond to these tutor moves and vice versa (Chi et al., 2001).

Student tutoring as a promising method to promote SRL

In contrast to the main focus on specific subjects as the curriculum of student tutoring (e.g., reading, mathematics), SRL has not been studied as the main focus within student tutoring programmes (Gordon et al., 2007; Topping, 1998). Although there are different theoretical perspectives on SRL, it is generally viewed as a complex, multi-faceted process integrating metacognitive aspects (e.g., planning, setting goals, organising, self-monitoring, and self-evaluating) with cognitive (e.g., selection of learning strategies, environmental structuring), as well as motivational aspects (e.g., self-efficacy, task interest, self-attributions) in order to effectively regulate one's learning process (Boekaerts, 1999; Pintrich, 2004; Winne & Hadwin, 1998; Zimmerman, 2000). However, most learners are limited in knowing, mastering, and performing most of these self-regulatory actions (Pintrich, 2004; Winne & Nesbit, 2009).

Different approaches can be combined to stimulate SRL, such as introducing SRL strategies by modelling, providing explicit instruction so students acquire knowledge on the how, when, and why to apply strategies, and offering various practice opportunities by creating powerful learning environments accompanied with close guidance and feedback (Boekaerts & Corno, 2005; Butler, 2002; Kistner et al., 2010; Perry, VandeKamp, Mercer, & Nordby, 2002; Pressley & Woloshyn, 1995; Schunk, 2001). Throughout this process towards appropriation of SRL, it is important that there is a transition of self-regulatory ownership. In a tutoring setting, this would concretely result in a shift from tutors providing direct instruction and modelling regulation (i.e., tutor-direct regulation) towards a situation in which the tutor prompts students to engage in SRL (i.e., tutor-indirect regulation) and the students start to take ownership of self-regulatory actions while still relying on the help of the tutor (i.e., tutee-indirect regulation) to finally reach the stage where they take control and demonstrate self-regulatory competence (i.e., tutee-direct regulation) (Hadwin et al., 2005; Schunk, 2001; Winne, 2005; Zimmerman, 2001). In order to evolve from external regulation to co-regulation (i.e., tutor- and tutee-indirect regulation) and to finally reach self-regulation, scaffolding is critical, implying that the tutor constantly fine-tunes his/her support based on students' changing knowledge and skills (Hadwin et al., 2005).

When considering the general characteristics of student tutoring it seems conceivable that student tutoring can function as a fruitful environment to promote SRL. First, the opportunity to provide more individualised support in tutoring initiatives is of particular relevance (Graesser & McNamara, 2010). When promoting SRL, it is important to build from students' existing knowledge and skills and to provide calibrated support based on an ongoing diagnosis of the students' level of understanding (Butler, 2002; Puntambekar & Hübscher, 2005). As tutoring occurs in one-to-one settings or in small groups, tutors are presumed to more easily assess individual differences among their tutees and fine-tune their support, and in doing so establish the zone of proximal development (Graesser & McNamara, 2010). Second, due to specific features of tutoring (i.e., the provision of immediate and relevant feedback, more active and interactive learning), a powerful learning environment is created in which tutees are empowered to take ownership of their learning (Chi et al., 2001; Gaustad, 1992; Gordon et al., 2007; Topping & Ehly, 2001). Third, the affective component of tutoring might be a powerful steppingstone for important motivational concepts regarding SRL (Gaustad, 1992; Karsenty, 2010; Topping & Ehly, 2001; Vandevelde, Van Keer, & Merchie, in press).

The present study

Despite growing interest in process-data, empirical research in this respect is still limited (Lepper & Woolverton, 2002; Roscoe & Chi, 2007). This is especially the case for studies focusing on student tutoring programmes. Moreover, to our knowledge, no prior process studies have been conducted in which cross-curricular skills, such as SRL, were the focus of the student tutoring programme. The present study aims to unravel the tutoring processes during student tutoring focusing on SRL. First, given the evidence that both tutor and tutee actions are substantial to understand tutoring processes, actions from both actors were inventoried instead of focusing solely on tutors. Second, to further explore the interactive nature of tutoring processes, we explore which actions precede particular tutor actions and how tutees respond to these tutor actions. These more detailed analyses were performed regarding two key tutoring actions, namely questioning and providing feedback. Third, from a self-regulatory point of view, not only does the frequency of occurrence of actions matter, but also the independent occurrence of tutees' actions without the direct or indirect involvement of the tutor. In this respect, we consider the self-regulatory ownership of actions and how this ownership evolves over time (Hadwin et al., 2005; Karasavvidis, Pieters, & Plomp, 2000).

In sum, the following research questions are put forward: (1) Which actions can be observed among tutor and tutees during student tutoring?; (2) Which actions precede and follow key tutor actions (i.e., questioning and providing feedback)?; (3) How does self-regulatory ownership evolve throughout the student tutoring process?

Method

Research context

This study was conducted in the seven-credit course 'Coaching and guidance' for first master students in Educational Sciences at Ghent University. The course provides students with theoretical background on different types of guidance in diverse educational contexts (e.g., coaching, tutoring, mentoring) and on processes and skills involved in these coaching and guidance activities. As a formal part of this course, the students are enrolled in a student tutoring programme. The aim of the tutoring programme is to empower fifth and sixth-grade primary school children with a low socio-economic and/or immigrant background by promoting SRL. In this respect, ten student tutoring sessions of approximately 100 minutes each were organised once a week during three successive months. Tutoring sessions were organised during school hours in small groups of two or three tutees per tutor.

Student tutoring sessions

As research shows that well-structured tutoring programmes are more effective (Gordon et al., 2007; Ritter et al., 2009), a tutoring curriculum script was designed, serving as a script-like macrostructure allowing deviations from the structure in order to tailor the sessions to tutees' needs. The curriculum script consisted of learning material for tutees and a manual for tutors detailing the learning goals and providing tutors with scenarios to address the selected SRL strategies (see Appendix A for an overview of the sessions). In line with recommendations of effective tutoring and promotion of SRL, tutors were instructed (1) to initially take the role as model and provide explicit instruction; (2) to provide deliberate practice applying the learning strategies across multiple contexts and tasks accompanied with feedback; (3) to approach tutees as active participants of their learning process; (4) to adjust the tutoring process to the needs of the tutees by means of dynamic scaffolding; and (5) to progressively encourage tutees to take responsibility for their learning.

In order to support the students in taking up their tutor role, they received prior training and ongoing support. The focus of the preparatory training was twofold. First, generic tutoring skills were discussed (e.g., questioning, prompting, scaffolding, providing feedback, and establishing a supportive relation) (Gordon et al., 2007; Graesser et al., 1995; King, 1997). In addition, the training also addressed promoting autonomous motivation and SRL (e.g., offering choices, opportunities for students to evaluate themselves and others, creating intrinsically motivating learning contexts, fading support) in particular (Butler, 2002; Hadwin et al., 2005; Perry et al., 2002). In view of ongoing tutor support, two interim small-group supervision sessions with the university instructors, three group meetings with the tutees' teacher, and individual feedback sessions with the university instructors were organised.

Participants

In total, 34 students in Educational Sciences (33 women, 1 man) were engaged as tutors and tutored 80 tutees (46 fifth grade, 34 sixth grade). The tutors had no prior experience with tutoring or stimulating SRL. In view of the present study, three first master students (all female; M_{age} = 21.28, SD = 0.31) were randomly selected from the 34 tutors. Two tutors tutored a group of two tutees (3 girls and 1 boy), and one tutor tutored a group of three tutees (3 girls; M_{age} = 11.13; SD_{age} = 0.55). Of each group, four tutoring sessions were video-taped (sessions 2, 4, 6, and 8).

Interaction analysis

In total, 1 071 minutes of video-data were collected. Tutoring sessions lasted on average 93.42 minutes (SD = 16.37). Coding was performed directly from the video-data, and both verbal and non-verbal behaviour was taken into account. As such, contextual and non-verbal information could be taken into consideration during the coding process. Data-analysis was conducted in four stages, mainly following the procedures of Chi et al. (2001) and Hadwin et al. (2005). Each stage was dependent on the prior stage.

Stage 1: Segmentation and action coding

In a first step, we segmented the video-data into separate units. To guide the segmentation process, the idea or purpose of an utterance, rather than the punctuation of length, was used. As such, one unit is equivalent to a single idea or action. In total, 11 280 units of meaning were distinguished. Each unit then received either a 'tutor' or 'tutee' code reflecting who performed a particular action. In a second step, each unit of meaning received an 'action' code. For this purpose, a coding scheme was developed based on a thorough literature review regarding instructional principles promoting SRL (e.g., Butler, 2002; Hadwin et al., 2005; Meyer & Turner, 2002; Perry et al., 2002) and essential tutoring skills (e.g., Berghmans et al., 2013; Chi et al., 2001; Graesser & McNamara, 2010; King, 1997; Lehman, D'Mello, Cade, & Person, 2012; Merrill et al., 1995). We tested and refined the coding scheme in order to embrace the data. The final coding scheme was comprised of 40 different codes clustered into nine categories: 'task-related actions', 'questioning and facilitation', 'providing answers, explanations and directions' 'structural-organisational actions', 'social-motivational actions', 'asking and providing feedback', 'monitoring comprehension and progress', and 'off-task behaviour' (see Appendix B).

Stage 2: Interaction coding

In addition to the action coding, we also specifically aimed at exploring the preceding actions of particular tutor moves on the one hand and the responses of tutees on the other hand(Chi et al., 2001). This coding was done by chaining the prior/following action and by taking into account who performed that action. As such, for each action it was determined which action preceded or followed and who performed the preceding or following action.

Stage 3: Ownership coding

In the third stage, each unit of meaning received a 'self-regulatory ownership' code. In line with Hadwin et al. (2005), we more distinguished four ownership types: (a) Tutor-direct regulation refers to instances where the tutor enacts or demonstrates a particular action. (b) Tutor-indirect-regulation entails instances in which the tutor initiates, but the emphasis is on inciting tutees to act, reflect, monitor, or evaluate their own behaviour, motivation, and cognition. In addition, tutees' actions as a response to the tutor's prompts also received a tutor-indirect-regulation code. (c) Tutee-indirect-regulation refers to actions in which tutees request assistance or information from the tutor and provides opportunities for the tutor to add to the conversation or to act, reflect, monitor, or evaluate. A tutor's reactions to these requests are coded as tutee-indirect-regulation as well. (d) Tutee-direct-regulation refers to actions in which the tutee completes the action or reflection.

Interrater reliability

Two trained coders independently double-coded 1 320 units of meaning (12% of all units), indicating good interrater reliability for stage 1 coding (Krippendorff's α = .82), and stage 3 coding (Krippendorff's α = .85) (Hayes & Krippendorff, 2007).

Data analysis

To describe tutors' and tutees' actions and the sequence of actions (i.e., research questions 1 and 2), descriptive analysis were performed on the different stages of coding. For each main category in the action coding with a relative frequency higher than 10% (i.e., 'task-related actions', 'questioning and facilitation', 'providing explanations and directions', 'structural-organisational actions', and 'asking and providing feedback'), we conducted chi-square analyses to investigate the relationship between the occurrence of the actions and the different tutor sessions on the one hand and the ownership of the actions on the other (i.e., research question

3). When the chi-square analysis showed a significant association, pairwise comparisons of ownership proportions within the sessions were conducted at the 0.05 significance level by making use of the Bonferroni correction, which adjusts the observed significance level for the fact that multiple comparisons are made. In addition, multinomial regression analyses were conducted with ownership as the dependent variable and session and group as independent variables. 'Session' was approached as a continuous variable, and 'group' as a categorical variable reflecting the three different tutoring groups.

Results

Tutor and tutee actions

In total, 11 280 units of meaning were coded, of which 52.69% were performed by tutors and 47.31% by tutees (see Table 1). During each tutoring session 940 statements were made on average, which were about equally divided between tutors (495 statements) and tutees (445 statements). As to the ownership codes, generally 13.31% of the units of meaning were coded as tutor-direct, 16.52% as tutee-direct, 22.31% as tutee-indirect, and 47.86% as tutor-indirect. Figure 1 shows the proportion of the different types of ownership within the main categories.

Table 1
Number of units of meaning across sessions and actor (tutor – tutee)

	Actor					
Session	Tutor		Tutee		Total	
	Freq.	%	Freq.	%	Freq.	%
2	1133	56.26	881	43.74	2014	100
4	1662	55.66	1324	44.34	2986	100
6	1797	49.22	1854	50.78	3651	100
8	1351	51.39	1278	48.61	2629	100
Total	5943	52.69	5337	47.31	11280	100

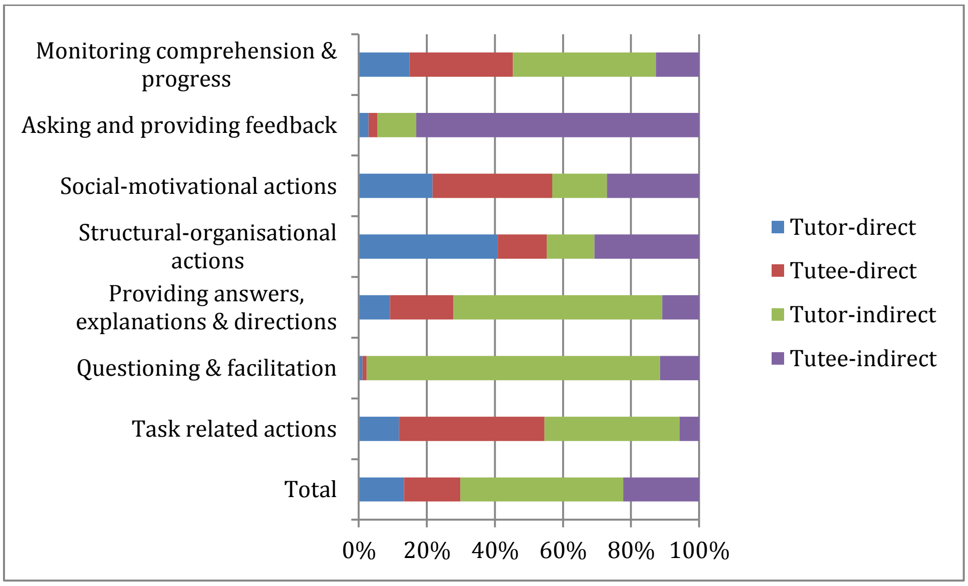

Figure 1. Proportion of the different types of ownership within the main categories.

Tutor actions

The most frequently observed tutor behaviour (see Table 2) was ‘questioning and facilitation’ (36.20%). Tutors mainly asked knowledge-review questions (25.74%) about the content provided in the curriculum script or learning strategy knowledge in general. Other questions, such as hinting (2.98%), probing (2.94%), comprehension-gauging (3.43%), or basic procedural questions (0.12%) occurred less often. Notably, tutors further engaged significantly in ‘structural-organisational actions’ (23.37%), mostly concerning management of the group process (14.13%) and basic procedural support (7.12%). Further, 17.65% of the tutor actions dealt with providing feedback or asking for process or performance evaluations. More particularly, tutors predominantly provided performance feedback in a rather superficial way (14.45%). Constructive performance feedback only occurred in 1.97% of the units. Contrary to the dominant occurrence of performance feedback, superficial (0.15%) or constructive (0.08%) tutor feedback regarding the learning process was practically non-existent, and tutors only seldom requested tutees to evaluate their own performance (0.25%) or learning process (0.74%). ‘Providing answers, explanations, and directions’ accounted for 11.11% of tutor actions. The vast majority of these actions consisted of giving content-related explanations (9.05%). Providing directive instructions (1.04%), non-elaborated answers (0.44%), explicit strategy instruction (0.25%), giving rationales (0.10%), and elaborated answers (0.22%) were hardly ever observed. As to tutors’ social-motivational actions (6.39%), they mainly focused on encouragement or praising (4.14%), while providing informal comments (0.76%) or assessing students’ motivation or interest (0.72%) were rare. Regarding ‘task-related actions’ (4.26%), tutors mostly engaged in goal setting (2.07%) or executing individual cognitive activity (1.77%). Further, only 1.02% of the units concerned ‘monitoring of comprehension and progress’. Among these actions, tutors mostly provided a synthesis of what was already discussed during the particular tutoring session (0.54%).

When considering the self-regulatory ownership of tutor actions, almost as many actions were labelled as tutor-indirect (38.33%) or tutee-indirect (36.73%), followed by tutor-direct regulation (24.95%). Tutor-indirect regulation almost exclusively concerned questioning and facilitation (92.31%). Tutee-indirect regulation mainly concerned providing feedback to tutees (43.81%), structural-organisational actions (26.17%), and providing explanations and directions (16.36%), implying that these actions were performed as a reaction to tutees' behaviour or on explicit tutee request. Among tutor-direct regulation, structural-organisational actions (52.56%) were most prevalent, followed by providing explanations and directions (20.38%), task-related actions (11.07%), and social-motivational actions (10.12%). Figure 2 shows the proportion of the different types of ownership within the main categories of tutor actions.

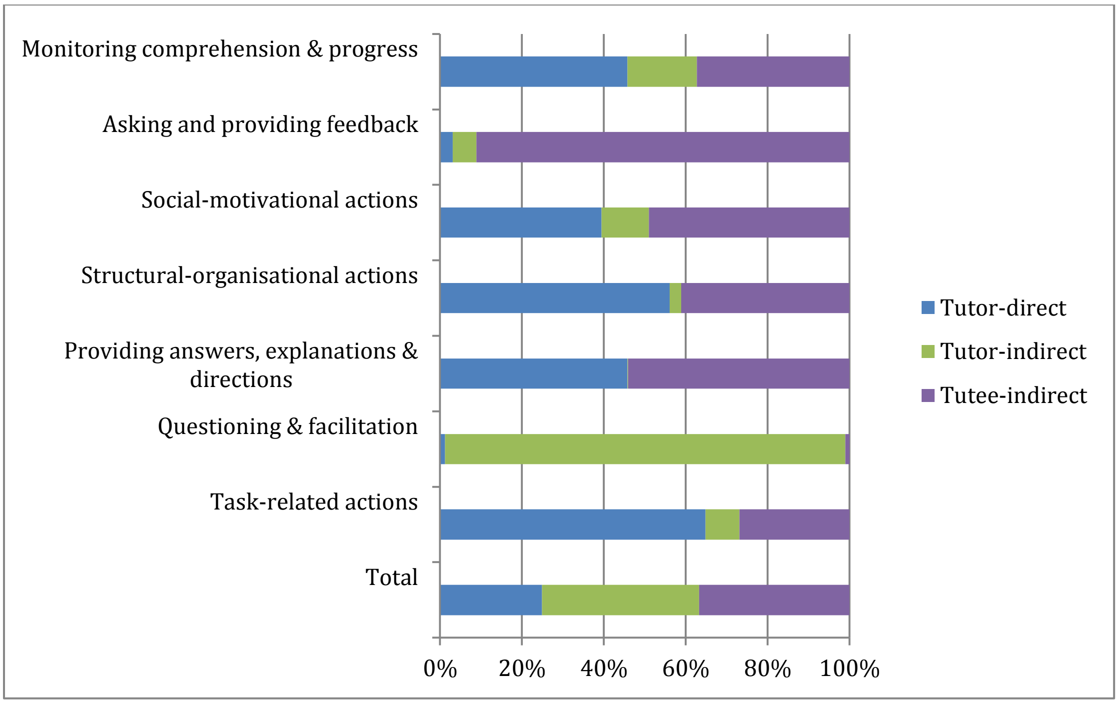

Figure 2. Proportion of different types of ownership within the main categories of tutor actions.

Table 2

Occurrence of tutor and tutee actions

(Sub)categories	Tutor Freq.	Tutor %[a]	Tutee Freq.	Tutee %[b]	Total Freq.	Total %[c]
Task-related actions	253	4.26	1132	21.21	1385	12.28
Reading instructions	4	0.07	31	0.58	35	0.31
Request to read instructions	4	0.07	1	0.02	5	0.04
Goal setting	123	2.07	10	0.19	133	1.18
Request for goal setting	17	0.29	17	0.32	34	0.30
Individual cognitive activity	105	1.77	1073	20.10	1178	10.44
Questioning and facilitation	2151	36.20	371	6.95	2522	22.36
Knowledge-review questions	1530	25.74	33	0.62	1563	13.86
Asking for rationale	13	0.22	1	0.02	14	0.12
Process-supportive questions	3	0.05	4	0.07	7	0.06
Referring	42	0.71	7	0.13	49	0.43
Probing questions	175	2.94	1	0.02	176	1.56
Hinting questions	177	2.98	4	0.07	181	1.60
Comprehension-gauging questions	204	3.43	16	0.30	220	1.95
Basic procedural questions	7	0.12	305	5.71	312	2.77
Providing answers, explanations, and directions	660	11.11	2632	49.32	3292	29.18
Content-related answers/explanations	538	9.05	1869	35.02	2407	21.34
Explicit strategy instruction	15	0.25	0	0.00	15	0.13
Providing rationale	6	0.10	13	0.24	19	0.17
Process-supportive directions	62	1.04	3	0.06	65	0.58
Elaborated answers	13	0.22	77	1.44	90	0.80
Non-elaborated answers	26	0.44	670	12.55	696	6.17
Structural-organisational actions	1389	23.37	518	9.71	1907	16.91
Planning	87	1.46	55	1.03	142	1.26
Request for planning	39	0.66	22	0.41	61	0.54
Management of group process	840	14.13	271	5.08	1111	9.85
Basic procedural support/actions	423	7.12	170	3.19	593	5.26
Social-motivational actions	380	6.39	311	5.83	691	6.13
Informal statements	45	0.76	187	3.50	232	2.06
Encouragement and praising	246	4.14	2	0.04	248	2.20
Motivational statement	23	0.39	110	2.06	133	1.18
Request for motivational statement	43	0.72	2	0.04	45	0.40
Motivational break	4	0.07	0	0.00	4	0.04
Guilt inducing language	19	0.32	10	0.19	29	0.26
Asking and providing feedback	1049	17.65	106	1.99	1155	10.24
Constructive process evaluation	5	0.08	5	0.09	10	0.09
Superficial process evaluation	9	0.15	8	0.15	17	0.15
Constructive performance evaluation	117	1.97	11	0.21	128	1.13
Superficial performance evaluation	859	14.45	76	1.42	935	8.29
Request for process evaluation	15	0.25	1	0.02	16	0.14
Request for performance evaluation	44	0.74	5	0.09	49	0.43
Monitoring comprehension and progress	59	0.99	122	2.29	181	1.60
Synthesising	32	0.54	17	0.32	49	0.43
Request for synthesising	6	0.10	2	0.04	8	0.07
Providing judgement of learning	9	0.15	99	1.85	108	0.96
Monitoring progress	8	0.13	4	0.07	12	0.11
Request for monitoring progress	4	0.07	0	0.00	4	0.04
Off-task behaviour	2	0.03	145	2.72	147	1.30
Total	5943	100.00	5337	100.00	11280	100.00

Note [a] relative frequency compared to the total number of units of tutors; [b] relative frequency compared to the total number of units of tutees; [c] relative frequency compared to the total number of units

Tutee actions

In general, tutees' actions were less diverse than tutors' actions. About half of the tutee actions (49.32%) consisted of 'providing answers, explanations, and directions' (see Table 2). While the majority of these actions were performed to give content-related answers (35.02%), non-elaborated answers (12.55%) or elaborated answers (1.44%) were also observed. Tutees also frequently engaged in 'task-related actions' (21.21%), dominated by individually executing a particular task (20.10%). Structural-organisational actions (9.71%) covered relatively less of tutees' actions. The most frequently observed actions within this category were management of the group process (5.08%) and basic-procedural actions (3.19%). Further, tutees' questioning behaviour (6.95%) mainly reflected asking basic procedural questions (5.71%), while other types of questions were hardly observed. Regarding 'social-motivational actions' (5.38%), tutees commonly made informal statements (3.50%) or expressed their motivation or task interest (2.06%). 'Monitoring of comprehension and progress' (2.29%) was infrequently observed, mainly characterised by providing judgements of learning. Finally, feedback actions (1.99%) were least reflected in tutees' actions. If this occurred, tutees mostly provided a superficial performance evaluation.

Tutee behaviour was primarily tutor-indirect (i.e., elicited by tutor moves; 58.76%), followed by tutee-direct (35.42%) and tutee-indirect (5.82%) ownership. Tutor-indirect regulation mainly concerned providing answers and explanations (66.14%) and performing task-related actions (17.31%). Tutee-indirect regulation was dominated by questioning (88.74%). Compared to the other ownership types, tutee-direct regulation was more divided across the main categories, such as 'task-related actions' (32.19%), 'providing answers, explanations and directions' (33.39%), 'structural-organisational actions' (14.90%), and 'social-motivational actions' (13.21%). Figure 3 shows the proportion of the different types of ownership within the main categories of tutee actions.

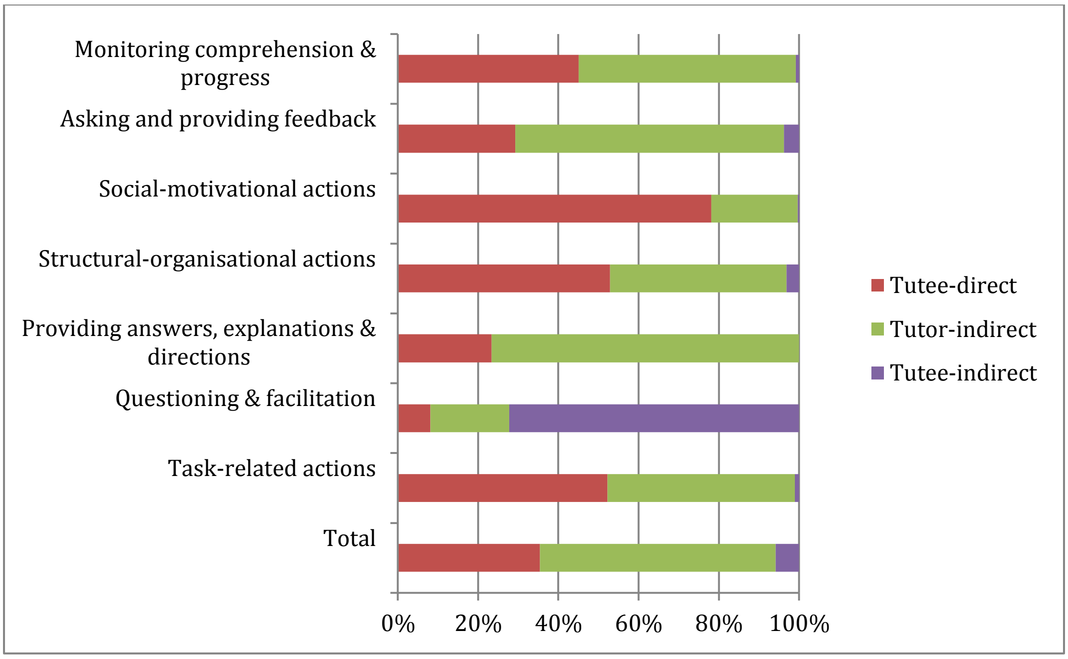

Figure 3. Proportion of different types of ownership within the main categories of tutee actions.

Interaction analysis

Given the amount of specific actions performed by tutors and tutees, we will only discuss a subset of actions with regard to the sequences with their preceding or elicited actions. In this respect, key tutoring strategies were selected, namely questioning and facilitation and providing feedback.

Preceding actions and responses to tutor questioning and facilitation

On average, 68.35% of tutors' questioning and facilitation was preceded by a tutee action and to a lesser extent by another tutor action (e.g., superficial performance evaluation, content-related answers or questions). Figure 4 displays the absolute frequency of occurrence of the three dominant tutee actions preceding tutors' content-related, probing, hinting, and comprehension-gauging questions, showing that content-related answers, non-elaborated answers, and individual cognitive activity were most commonly observed as precursors. Further, 88.34% of tutors' questioning and facilitation actions were followed by a tutee response. In the other cases (11.28%), tutor actions were followed by another tutor action (e.g., asking subsequent questions, structural-organisational actions, answering). As to the former sequences, tutors' questioning and facilitation elicited quite diverse tutee responses. This was especially the case regarding content-related questions. On average, 12 different types of tutee responses were observed after a tutor question. Across the four types of tutor questioning (see Fig. 4), content-related and non-elaborated tutee answers were the most frequent responses. Elaborated answers were, however, only prompted by probing questions. Cognitive activity was also observed as a response to tutors' content-related and hinting questions, whereas in a limited amount of cases comprehension-gauging questions elicited judgements of learning.

Preceding actions and responses to tutor feedback

Although tutors' feedback sometimes (19.54%) was preceded by another tutor action (e.g., superficial performance evaluation, content-related answers, structural-organisational actions), in most cases (80.46%) tutees' actions preceded tutors' feedback. Figure 5 displays tutees' actions preceding tutor feedback in more detail. It can be noticed that feedback was in most cases given after tutees provided content-related, elaborated, and non-elaborated answers or performed a cognitive activity. Notwithstanding that feedback is mostly preceded by a tutee action, only in 36.36% of the cases did tutor feedback prompt action from the tutees. Although the proportional amount of tutee reactions was comparable for tutors' performance feedback (38.55%) and process feedback (34.72%), performance feedback elicited a larger variation of tutee responses (on average 16) than judgements regarding the learning process (on average 3.5). While content-related answers and cognitive activity were the most frequent reactions of tutees on tutor feedback, non-elaborated answers, structural-organisational actions, and superficial judgement of performance were also observed. When a tutor action (63.37%) followed tutor feedback, this mostly concerned asking questions.

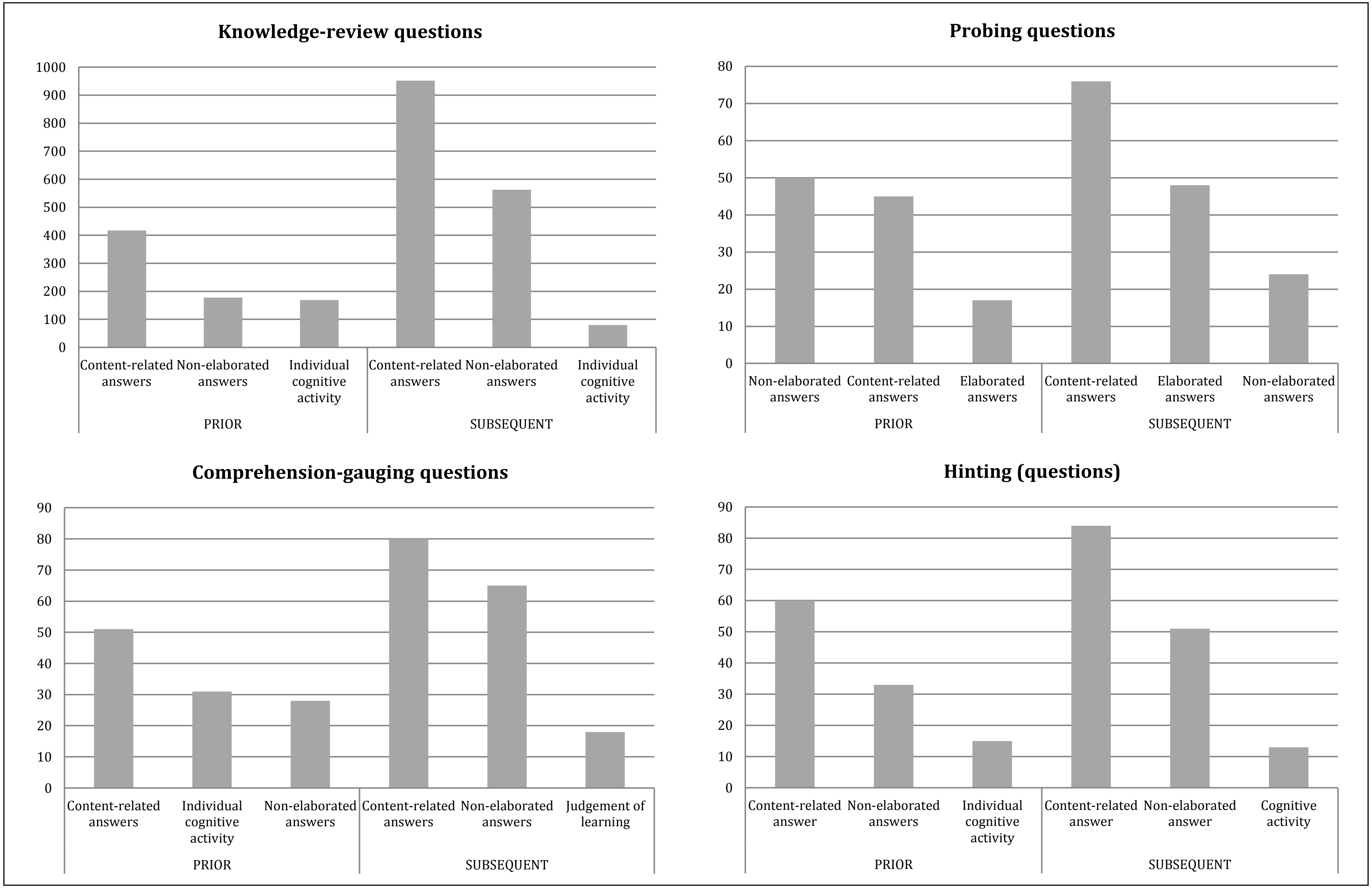

Figure 4. Frequency of occurrence of the three dominant types of tutee actions prior or subsequent to tutor questioning and facilitation.

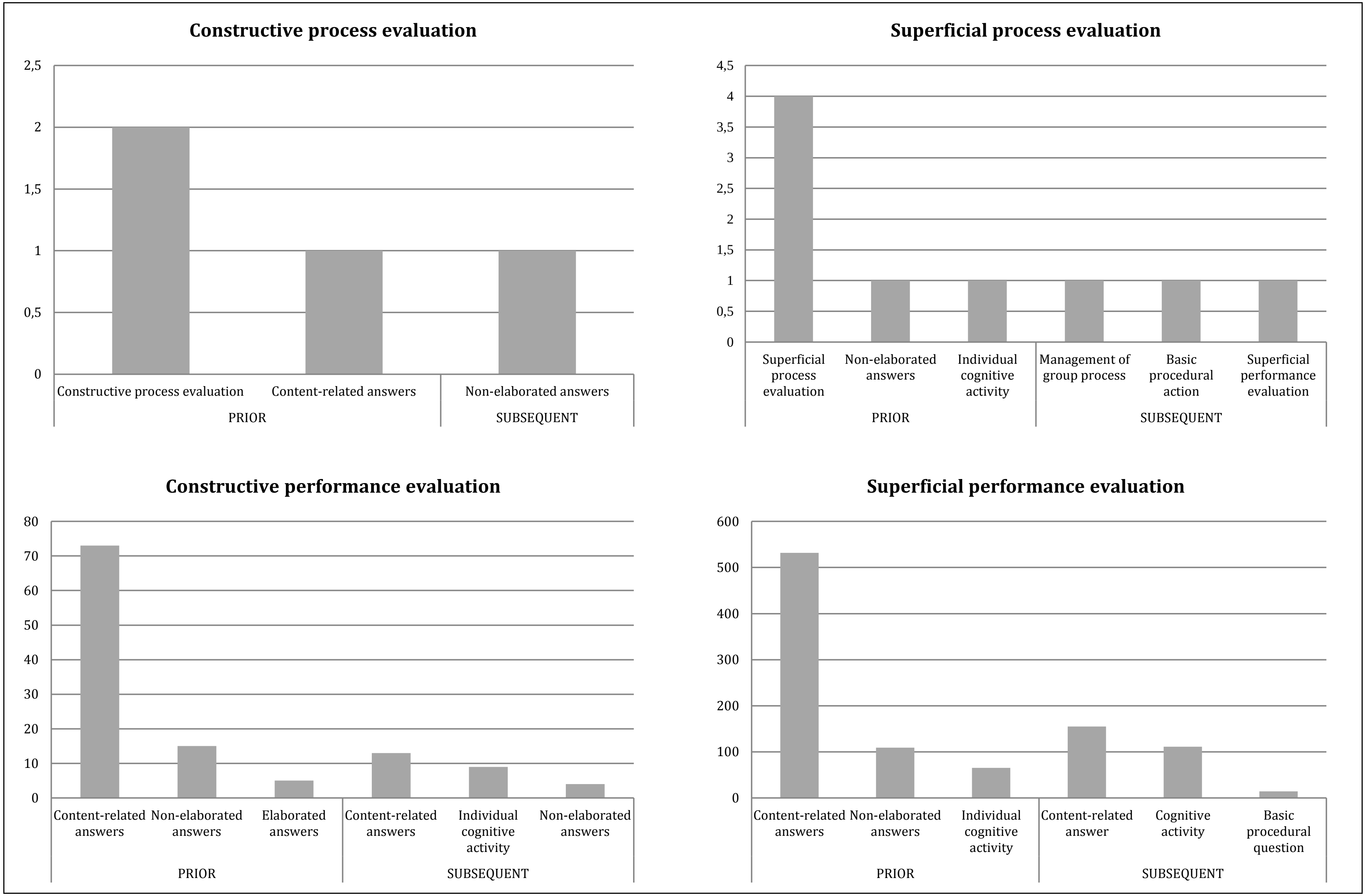

Figure 5. Frequency of occurrence of the three dominant types of tutee actions prior or subsequent to tutor feedback.

Shift in self-regulatory ownership

Chi-square analyses show significant differences between the tutor sessions as to the distribution in the four ownership types for ‘task-related action’ (χ^2= 86.06, *df* = 9, *p* < .001), ‘questioning and facilitation’ (χ^2= 53.41, *df* = 9, *p* < .001), ‘providing answers, explanations and directions’ (χ^2= 199.04, *df* = 9, *p* < .001), ‘structural-organisational actions’ (χ^2= 61.49, *df* = 9, *p* < .001), and ‘asking and providing feedback’ (χ^2= 48.60, *df* = 9, *p* < .001). Based on Figure 6 and pairwise comparisons, more details can be deduced. Below, we highlight the most important findings in this respect.

Regarding ‘task-related actions’, the most striking differences over the sessions are observed regarding the occurrence of tutor-indirect and tutee-direct ownership. Compared to sessions 2 and 4, the proportional amount of tutor-indirect regulation is significantly lower than in sessions 6 and 8, and this in favour of the proportion of tutee-direct regulation, which is significantly higher during the last two observations. Based on the subcategories of task-related actions, it seems that this shift primarily concerned cognitive activities, since during the last two tutoring sessions these activities were more often self-initiated by the tutees.

As to ‘questioning and facilitation’ behaviour, tutor-indirect regulation clearly dominated the interaction across the sessions. However, after session 2 a small but significant decrease in the proportion of tutor-indirect regulation is observed which continues until session 6. In conjunction, a growth in tutee-indirect regulation after session 2 can be noticed. Based on the subcategories, it can be noticed that tutees asked more basic procedural questions in the last three observations compared to the first observation.

With respect to ‘providing answers, explanations, and directions’, a significant increase of tutor-direct regulation in session 4 is observed. Also, the proportion of tutee-indirect regulation shows a significant increase in session 4. Except for a significantly larger proportion of tutee-direct regulation in session 6, the amount of self-initiated explanations by tutees remained relatively stable. Further, the proportion of tutor-indirect regulation shows a significantly decreasing trend over the sessions, implying that tutees’ explanations elicited by tutor actions diminished. Consequently, the tutors in particular increasingly provided explanations, both self-initiated as elicited by the tutees.

Regarding ‘structural-organisational actions’, a significant drop in the proportion of tutor-direct actions in session 8 can be observed, accompanied with an increase of tutor-indirect actions. However, these shifts concerned other topics. Whereas the decrease in tutor-direct regulation was largely due to a decline in providing basic procedural support, the increase in tutor-indirect regulation mainly concerned an increase of tutors’ request for planning and tutees’ planning behaviour as a response to those requests.

With respect to ‘asking and providing feedback’, an increasing trend of tutor-indirect actions can be observed in conjunction with a decrease of tutee-indirect actions. As such, tutors reduced their feedback as a reaction to tutees’ actions or requests and increasingly tried to elicit such reflections on process and performance in their tutees, actually resulting in proportionally more tutee reflections as tutor-indirect behaviour.

Further, based on the descriptive results, differences between the three tutoring groups were observed. Therefore, we explored whether group has a main effect on ownership and whether the evolution in ownership differs between the groups. Table 3 shows the results of the multinomial regression analysis on the different main categories. These results confirm the main effect of session regarding 'task-related actions', 'questioning and facilitation', 'providing answers, explanations, and directions', 'structural-organisational actions', and 'asking and providing feedback'. In addition, the results show a main effect of group regarding all categories. A significant interaction effect between session and group was also found regarding 'task-related actions', 'providing answers, explanations, and directions', and 'asking and providing feedback'. However, similar patterns are observed in the different groups, but in some groups these patterns were more pronounced than in other groups. As an illustration, Figure 7 shows the distribution of the different types of ownership for the three groups regarding 'task-related actions'. This figure illustrates that in each group the reported shift in tutor-direct and tutor-indirect can be observed, but in group 3 it was less pronounced as compared to groups 1 and 2.

Table 3

Results of multinomial regression analysis

	Session			Group			Session*Group		
Main categories	χ^2	*df*	*p*	χ^2	*df*	*p*	χ^2	*df*	*p*
Task-related behaviour	23.84	3	<.001	45.62	6	<.001	25.17	6	<.001
Questioning & facilitation	22.11	3	<.001	14.31	6	.026	8.05	6	.234
Providing explanations & directions	28.46	3	<.001	83.99	6	<.001	21.97	6	.001
Structural-organisational	27.28	3	<.001	22.70	6	<.001	8.35	6	.213
Feedback	12.21	3	.007	25.81	6	<.001	12.87	6	.045

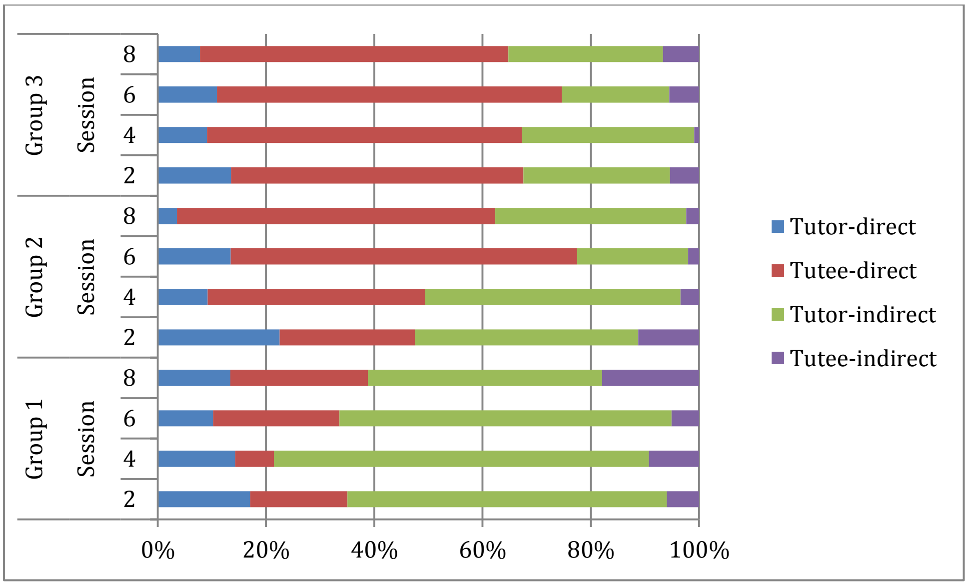

Figure 7. Distribution of the different types of ownership for the three groups regarding 'task-related actions'

Figure 6. Distribution of the different types of ownership per main category of the coded tutor/tutee actions and per tutoring session.

Discussion

This study sought to deepen our understanding of student tutoring processes focusing on the promotion of tutees' SRL by not only detailing tutors' and tutees' actions, but also by documenting the interaction among specific actions as well as by exploring how self-regulatory ownership evolves throughout the tutoring sessions.

Tutor and tutee actions

A first remarkable finding was that, in contrast to most prior studies (e.g., Berghmans et al., 2013; Chi et al., 2001; Graesser et al., 1995; VanLehn et al., 2003), no clear dominance of tutor actions was observed in the student tutoring dialogue. Instead, tutor and tutees almost equally contributed to the sessions. Although we cannot directly compare with the amount of student statements in a traditional classroom, a calculation shows that if each student in a classroom would contribute statements at the same rate as observed in the current study (i.e., 41 statements/hour), this would mean that in a class of 20 students, a total of 820 student statements would be articulated per hour, which is practically impossible. While the amount of statements is of course a rough measure, these results confirm that tutees have greater opportunities to be more active in a tutoring situation as compared to a hypothetical classroom situation (Chi et al., 2001). An additional indicator of more active and constructive tutee behaviour in the tutoring context is the number of tutee questions. A typical student in a classroom asks on average 0.11 questions per hour (Graesser & Person, 1994), whereas a tutee in the current tutoring environment asks on average 2.80 questions per hour. Although this number is lower than the amount of questions reported in prior studies focusing on older students and in one-to-one tutoring (Chi et al., 2001; Graesser & Person, 1994), the data support the assumption that a tutoring setting offers tutees more opportunities to engage more actively in learning.

When considering tutor actions, the results illustrate that tutors adopted a wide range of strategies during student tutoring. In contrast to prior studies (Berghmans et al., 2013; Chi et al., 2008; Chi et al., 2001), tutors in the current tutoring programme devoted most of their efforts to question asking and facilitation rather than to explaining. This divergent finding might be explained by the explicit focus on SRL during tutoring and the prior training tutors accordingly received. In the training it was repeatedly stressed that tutors should approach their tutees as active participants and to see their tutoring role as a coach rather than instructor, which might have influenced tutors' perceptions of their role. In line with Roscoe (2014), we believe that tutors' perceptions of the tutoring role and learning in a broader sense may influence their choice of tutoring behaviours (i.e., epistemological hypothesis). As questioning and prompting have been found to be more beneficial for learning than adopting a directive and didactic style, this is a positive finding (Chi et al., 2001; VanLehn et al., 2003).

Though it is positive that tutors adopted a more interactive style by trying to get the students to do the acting and talking through questioning, it should nevertheless be noted that the majority of the questions were knowledge-review questions. Questions requiring deeper reasoning or reflection, such as probing questions, constituted a small proportion of their questioning behaviour. Similar patterns were shown in previous studies (Berghmans et al., 2013; Graesser et al., 1995; Roscoe & Chi, 2007). Tutors may avoid asking more difficult questions as a precaution against negatively affecting tutees' motivation or self-confidence (Person, Graesser, Magliano, & Kreuz, 1994). Tutors in the present study also engaged quite often in structural-organisational actions, which might be due to the small-group setting of the current tutoring programme requiring more attention to these aspects as compared to one-on-one tutoring (Berghmans et al., 2013; Grau & Whitebread, 2012).

Further, the provision of feedback was characterised by the prevalence of (superficial) performance evaluations, while mainly constructive feedback regarding the learning process is more preferable to enhance SRL (Nicol & Macfarlane-Dick, 2006; van den Boom, Paas, & van Merriënboer, 2007). Tutors in the current study were also sensitive to the tutees' motivation. This is of particular relevance given our specific target group - students at risk of school failure - is frequently characterised by low self-esteem or in need of attention and relatedness (Hamre & Pianta, 2001; Karsenty, 2010).

These results also provide practical cues for tutor training. Although the current training was successful in providing tutors with the adequate mindset regarding their tutor role, it might be necessary to supplement it with more targeted training and hands-on practice opportunities (e.g., how to ask deep-level questions, how to give high-quality feedback) in order to enhance the likelihood that both tutors and tutees fully exploit the opportunities inherent in student tutoring.

When considering tutees' actions, it appears that these were less diverse than the tutors' actions. Besides task-related actions, tutees' actions mainly reflected providing answers and explanations, of which the vast majority was a response to tutors' questions and to a lesser extent self-initiated. This is a remarkable finding, since in a typical tutoring situation giving explanations is mainly observed as a responsibility of the tutors (Chi et al., 2001; Graesser et al., 1995). Further, tutees mostly provided content-related explanations. These findings can be linked to the results of the interaction coding, revealing that those answers/explanations mainly were responses to knowledge-review questions. These findings and the dominant presence of tutor knowledge-review questions also suggest that during the tutoring sessions the focus was more on strategy knowledge than on the application and practice of self-regulatory learning strategies. Although tutors were instructed to provide additional practice opportunities tailored to students' specific needs and classroom activities, it seems that providing tutors with a curriculum script reinforced them to follow that script and hampering them to integrate additional practice opportunities (Chi et al., 2008; Graesser et al., 1995; VanLehn, 2011). The limited amount of SRL actions (e.g., goal setting, planning, monitoring, or evaluations) performed by the tutees also confirms this assumption. In cases where tutees did display such actions, it was almost exclusively on tutor request. These findings are in line with prior studies describing a rather pessimistic picture of tutees' SRL and underscoring the need to train students in SRL (Graesser et al., 2009; Graesser & McNamara, 2010).

However, besides the high frequency of providing answers and explanations, additional evidence of more active learning is that tutees ask more questions in the tutoring setting than in the classroom setting (see above). In spite of the comparatively higher incidences of tutee questions, tutee questioning was still limited and was mainly shallow, such as asking how to perform a task or procedure, rather than deep-level questions (Graesser et al., 1995). In this respect, it has been argued that putting students in cognitive disequilibrium will stimulate them to ask more deep-level questions and engage in deeper learning (Graesser et al., 2009; VanLehn et al., 2003). Thus, tutors should be encouraged to create situations in which students are confronted with contradictions, obstacles to goals and challenges, but without losing the affective component out of sight.

Interaction analysis

Although only the preceding and subsequent actions were explored and not larger episodes of tutoring dialogue, the observed dialogue patterns clearly reflected the five–step tutoring frame (Graesser et al., 1995). As pointed out earlier, the high occurrence of tutor questioning and the corresponding answers or explanations by tutees also indicate the presence of collaborative discourse moves (i.e., step 4 of the tutoring frame) that encouraged tutees to actively participate in the tutoring process (Chi et al., 2001; Graesser et al., 1995). Although it is possible that tutees show some resistance, especially at the outset, to an indirect approach relying on questions and hints rather than on explanations and directions (Lepper & Woolverton, 2002), tutees in this study were highly responsive to tutor questioning, of which the occurrence of content-related answers outweighed the occurrence of non-elaborated answers. While the latter might be caused by tutors' tendency to ask close-ended questions, it also suggests that not only the particular tutor move, but also how the tutee responds to that move is important to establish a powerful learning environment (Chi et al., 2001). Interestingly, the current findings also confirm that probing questions are more successful to prompt elaborative responses. Further, in line with prior studies (Chi et al., 2001), the results show that feedback elicited less constructive responses from the tutees. It is possible that the tutees had difficulties reacting to the feedback in a constructive way because they had trouble making sense of it and to react on it in (Chi et al., 2008). Finally, the interaction analysis also illustrates a lack of systematicity (Chi et al., 2001), both regarding the kind of moves on which tutors responded with questioning or feedback as regarding tutees' responses to those actions. Even though dominant types of preceding and subsequent actions on tutor moves were found, a distribution of different actions was also observed, especially regarding questioning. Further research is needed to uncover the specific aspects of the interaction, such as the specific content of the dialogue or the intentions of the tutor/tutee, which might explain why tutors or tutees respond in a specific way to particular moves.

Shift in ownership

Given the goal of the tutoring sessions, namely stimulating tutees' SRL, an increase in tutee-direct regulation and a decrease in tutor-direct regulation over time is expected with co-regulation (i.e., tutor-indirect and tutee-indirect regulation) as a transitional process towards the appreciation of SRL (Hadwin et al., 2005; Zimmerman, 2000). However, in general, such a pattern could not be observed in the present study. First, it can be seen that tutors displayed to a rather limited extent directive and modelling behaviour (i.e., tutor-direct), even at the beginning of the tutoring programme. In contrast, the predominance of co-regulation could be observed from the outset until the end of the programme. So, the modelling-scaffolding-fading principle was not reflected in the current tutoring processes over time. The inclination towards co-regulation on the part of the tutors might be viewed within the light of tutors' perception regarding their tutor role (Cade et al., 2008; De Smet, Van Keer, & Valcke, 2009). As pointed out above, a more coaching tutoring style was highlighted during the prior tutor training. Tutors were instructed to not be overtly directive so that tutees could take responsibility for their own learning process and progress. The current findings suggest that tutors integrated this advice in their tutoring practices, but paid less attention to other important principles regarding effective tutoring (e.g., modelling-scaffolding-fading) and stimulating SRL (e.g., explicit instruction, offering practice opportunities), which were also addressed during training. However, applying such sophisticated pedagogical strategies is a complex and highly demanding task for minimally trained tutors, since even expert tutors (Cade et al., 2008; Graesser et al., 2009) and experienced teachers struggle to implement such strategies (van de Pol, Volman, & Beishuizen, 2012). As suggested above, further studies could extend current tutor training with more targeted training and more hands-on practice. However, prior studies also indicate that tutors do not always adopt or continue using the strategies addressed in training (Dufrene, Noell, Gilbertson, & Duhan, 2005). Therefore, prior training should also be combined with ongoing support that is more intensive and individualised than provided in this study.

In a tutoring setting, not only the quality of tutor behaviour counts (Chi et al., 2001). While tutors can do their best to activate tutees, tutees also must be willing to take up this challenge. In a traditional classroom few opportunities are provided to students to regulate their learning. So, when students are put in a tutoring setting, they are confronted with a more interactive learning environment which may challenge their dominant perceptions regarding their role as a learner (Rasku-Puttonen, Eteläpelto, Arvaja, & Häkkinen, 2003). To fully exploit the opportunities of the tutoring context, tutees must be willing to take responsibility for their own learning and resist the tendency to rely heavily on others in order to guide, monitor, and evaluate their learning (Rasku-Puttonen et al., 2003). Although the current findings show some movements towards growing SRL among tutees (i.e., increase of tutee-direct regulation of task-related actions and increase of tutee-indirect regulation of questioning and explaining), no strong or clear evidence of tutees' increasing SRL behaviour was observed. Given the complexity of SRL and the young age and vulnerable educational position of the target group in the current setting, it might be too high an expectation to see such evolution in a rather short period of time (i.e., 10 weeks). In this respect, investigating these processes over a longer period of time would be interesting. Further, in line with the assumption that student participation in learning contexts is also influenced by their perceptions of the context, it can be explored whether informing tutees beforehand on their role as a tutee would influence their perceptions and actions accordingly.

Another issue that surfaced in this analysis is the variation between groups in their evolution in self-regulatory ownership regarding some actions. First, tutoring is the result of an interaction process between tutor and tutees and ideally builds on the evolving demands and grounding acts of the tutees (Pata, Sarapuu, & Lehtinen, 2005). Therefore, the difference between groups might reflect tutors' attempts to provide contingent support. As it is feasible that tutees' needs and competence in regulating their learning vary considerably, it seems plausible that these differences resulted in different distributions of self-regulatory ownership across groups. Otherwise, it is also possible that the variation reflect different tutoring styles leading to different distributions of self-regulatory ownership. By engaging more different groups and additional analyses (e.g., cluster analysis to investigate tutoring styles), further research could shed light on this matter. Beside variation between groups, it also can be noted that different patterns of self-regulatory ownership and evolution herein are observed across the main categories of actions. These findings underscore the value to explore self-regulatory ownership regarding these different clusters of actions. In sum, our findings indicate that the transition from external regulation to self-regulation is an extremely complicated phenomenon which is not easily achieved in the short-term within a student tutoring setting.

Implications for further research

Throughout the discussion some implications for practice and research were already noted. In this section, we want to provide additional suggestions for further research related to particular limitations of the current study. First, given the fine-grained level of analysis, only a limited number of tutoring groups were followed extensively. Although this small sample complicates generalisations and proper hypothesis testing, it can be considered to be an onset for future research engaging a higher amount of tutoring groups and collecting data over a longer period of time. Second, the study was conducted in a particular setting. In the current tutoring programme small groups were used as contact arrangement and students with specific background characteristics were engaged as tutees. Moreover, the tutors in current setting were all female. Future research should verify the findings by involving other tutor and student populations as well as other contact arrangements. Further, in the current student tutoring programme a curriculum script was provided. While studies show that well-structured programmes yield higher effects (Cohen et al., 1982; Ritter et al., 2009), some process studies also state that it might function as an additional barrier to provide adaptive support (Graesser et al., 2009). Future studies could investigate whether providing a curriculum script indeed hampers adaptive support.

Besides these suggestions regarding the design of further research, some suggestions regarding data analysis can also be made. In this respect, additional coding with a larger grain size would be valuable, such as supplementing the current coding with episode coding. For example, based on the current interaction analysis we could see which tutee actions preceded a comprehension-gauging question and how tutees responded to that question. But within one dialogue topic multiple turns can occur. If a larger grain size is applied, it would also be possible to detect whether a tutor builds further on this response by asking the tutee to demonstrate his/her understanding instead of relying on the tutee's answer, which is often quite misleading (Graesser et al., 2009; Graesser et al., 1995).

Similarly, episode coding also enables researchers to investigate to a larger extent the degree of adaptiveness of the provided support. In line with the main characteristics of scaffolding, further research could explore in depth whether a tutor has chosen the appropriate move given the specific situation and needs of the tutees, whether the tutor provided feedback, hints, and explanations when needed, and whether these actions were based on continuous assessment of the tutees' competence and understanding. For example, the current analysis revealed that tutors posed questions at a high rate, creating a platform for continuous assessment and diagnosis (Chi et al., 2001). However, based on the current analysis it is not possible to infer whether tutors also actually used these incidents to diagnose tutees' understanding and adjust their actions accordingly. Furthermore, although the coding scheme was rather detailed, a more profound consideration of the content of actions will reveal additional data on the quality of tutor and tutee actions (e.g., how accurate was the tutors' feedback on incorrect answers). Additionally, this kind of analysis could also be combined with stimulated recall interviews of both tutors and tutees regarding their perceptions and intentions of tutoring processes in order to gain more insight into the interplay of those perceptions and intentions and their actions.

Finally, the current study mainly provides rich descriptive data on tutors' and tutees' actions and the interaction processes. Given that output-related variables were not included in the present study, no empirical claims could be made regarding which actions or interactions are most desirable to promote SRL within a student tutoring setting. Future research could look into this further by combining process data with outcome data.

Conclusion

Recently, interest has shifted from addressing the outcomes of tutoring to understanding the nature of the tutoring processes. Despite growing consensus on their relevance, process studies remain an empirically underexplored domain in tutoring research. Studies focusing on student tutoring in particular are comparatively sparse in the research literature. Moreover, to our knowledge, studies investigating tutoring processes during student tutoring focusing on SRL have not been conducted.

This study illustrates some of the claims towards student tutoring as a fruitful method to stimulate SRL (e.g., more opportunities for active learning, attention to affective and motivational components). Further, it provides a more optimistic picture of the nature of the tutoring process by showing that tutoring sessions with the goal to advance SRL are mainly characterised by an interaction-centred approach which is perceived as beneficial (Chi et al., 2001). At the same time, it also illustrates that it is not a matter of course to expect high-quality support from minimally trained tutors, and that a rather brief tutoring programme might be insufficient to empower students towards more self-regulation, as we could not observe a clear increase of tutee-direct regulations. Further, by using a detailed coding scheme, this study provides a rich view on tutor and tutee activities and the obstacles they face in establishing high-quality and sophisticated tutoring, in particular regarding tutoring on SRL. This information can be used to optimise future tutor training and support in student tutoring programmes focusing on SRL, which is perceived as one possibility to enhance deeper learning in tutoring settings (Graesser et al., 2009). Finally, the study provides input for further research in the hope to inspire upcoming empirical studies addressing student tutoring processes and how these are in line with the promotion of SRL or how these processes can be optimised to stimulate SRL.

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Appendix A

Overview of the intervention content

Session	Content	Example of activities
1	Self-reflection on one's own learning	Identifying personal strengths and weaknesses in study behaviour
2	SRL cyclical phases: use of forethought, performance control, and self-reflection processes. Operationalised as: task definition; goal setting and planning; execution of the task and monitoring; global evaluation	Performing an activity according to a step-by-step plan
3	Goal setting, time-management and environmental structuring	Estimating duration of a task and comparison with actual time-use
4	Activating prior knowledge, text comprehension, asking questions	Predicting the content of a text by scanning
5	Distinguishing main issues from side-issues, structuring texts through indicating keywords	Highlighting key words in text
6	Representing texts schematically through mind mapping	Making a mind map of a text
7	Memorising techniques	Practising mnemonics techniques
8 +9[a]	Preparing an oral presentation about a self-selected theme (integrating and applying the learned self-regulatory strategies)[b]	
10	Oral presentation	

Note: [a] Following the statement of Perry et al. (2004) that complex tasks are effective forms promoting SRL, the last two sessions were reserved for a complex assignment, namely preparing an oral presentation about a self-selected theme giving the students the opportunity to integrate and apply the learned self-regulated strategies. As the sixth graders had already participated in the student tutoring programme during the previous school year, they started with this assignment in session 4.

Appendix B

Coding scheme

(Sub)categories	Description	Example
Task-related actions		
Reading instructions	Reading task instructions	[Tutee reads task instructions out loud]
Request to read instructions	Request to read task instructions	Tutor: Can you read the instructions out loud?
Goal setting	Describing and providing concrete goals to guide task performance before commencing the task	Tutor: Each of you has received cards. On the red cards, there are some questions. On the green cards, you can find the right answers. Try to match the cards. One card only matches one other card.
Request for goal setting	Request to set goals or paraphrase previous provided instructions.	Tutor: So, what do you have to do now?
Individual cognitive activity	Individually executing a task	[Tutee reads the text and marks the difficult words.]
Questioning and scaffolding		
Knowledge/review questions	Asking review or knowledge questions regarding the content of the curriculum script or learning strategy knowledge in general	Tutor: When do you have to plan: before, during, or after a task?
Asking for rationale	Asking why a certain strategy or action is helpful	Tutor: Why is it important to read the instructions carefully?
Process-supportive questions	Asking specific guidelines on how to approach a task	Tutee: Can I also do it in this way?
Referring	Referring to additional resources	Tutor: You can also use a dictionary.
Probing questions	Request to further explain or elaborate on prior explanations/answers or request to relate the work/content in the session to other contexts	Tutor: What do you mean by that?
Hinting (questions)	Trying to lead the tutee to the right answer by given specific prompts	Tutor: Do you think this pictogram refers to planning? Look once again, what is he holding?
Comprehension-gauging questions	Questions to gauge tutees' understanding	Tutor: Do you understand the difference?
Basic procedural questions	Questions regarding practical and content-specific aspects of a particular task	Tutee: Where do I have to write it?

Providing answers, explanations, and directions		
Content-related answers/explanations	Providing self-initiated or elicited explanations regarding the content of the curriculum script or regarding learning strategy knowledge or use in general	Tutee: I think I would highlight and write down the difficult word and afterwards I would ask my dad or mom.
Explicit strategy instruction	Providing explicit instruction (what, when, why, and how) on a particular self-regulated learning strategy	Tutor gives more background information why Mind Mapping and the corresponding characteristic of Mind Mapping can help to better understand and learn a text.
Providing rationale	Clarifying why a certain strategy or action is helpful	Tutee: If you do not understand a word, you will not understand the assignment.
Process-supportive directions	Providing specific guidelines on how to approach a task	Tutor: I suggest you first take a look at the text.
Elaborated answers	Providing elaboration to a previous explanation or relating the content/work of the session to other contexts	Tutee: Yes, while studying, I always write down some questions and after a while I try to solve them.
Non-elaborated answers	Providing a short answer without further elaboration	Tutee: No
Structural-organisational		
Planning	Making a time planning (e.g., by listing all the activities, prioritise activities, and allocate time for the different activities)	Tutor: Today, we will start with a short rehearsal from last week, and afterwards we will make a step-by-step plan.
Request planning	Request to make a time planning	Tutor: How much time do we have to prepare the presentation?
Management of the group process	Ensuring a learning environment that is conducive to learning and keeping group members on task and engaged in learning	Tutor: First, we are going to listen to S.
Basic procedural support/actions	Providing/enacting basic procedural and organisational support/actions	Tutor: You can put your book here. Now, we have some more space.
Socio-motivational actions		
Informal statements	Making an informal statement and sharing personal experiences which have no connection with the topic at hand.	Tutee: Do you like pancakes?
Encouragement and praising	Providing praise and encouragement	Tutor: That looks great!
Motivational statements	Providing statements regarding motivation, such as task interest or self-efficacy	Tutee: I find it difficult to make a mind map.
Request for motivational statement	Request for a statement regarding motivation, such as task interest or self-efficacy	Tutor: Did you like making a mind map?

Motivational break	Inserting a break to improve the motivation and concentration afterwards	Tutor and tutee play UNO.
Negative remarks	Making negative or sarcastic comments about tutor/tutees ability or efforts	Tutor: Oh, were you not paying attention? That's a pity.
Asking and providing feedback		
Constructive process evaluation	Providing specific and concrete evaluation/reflection on the learning process with clear suggestions for the future	Tutor: Well done. I saw that you carefully checked your summary, both during and after the assignment.
Superficial process evaluation	Providing general and vague evaluation/reflection on the learning process without clear suggestions for the future	Tutor: Ok, that went smoothly.
Constructive performance evaluation	Providing specific and concrete evaluation/reflection on the learning performance	Tutor: That's right. Everyone has a different finger print.
Superficial performance evaluation	Providing general and vague evaluation/reflection on the learning performance without clear suggestions for the future.	Tutor: Yes, that's right.
Request for process evaluation	Request to examine the strengths and weaknesses in the learning process	Tutor: Did we do a good job?
Request for performance evaluation	Request to examine the strengths and weaknesses of the learning performance	Tutor: Is this result correct?
Monitoring comprehension and progress		
Synthesising	Providing an overview of the session(s)	Tutor: Ok, what have we done so far? We looked at the titles, subtitle, and figures, we searched for difficult words and talked about tricks to help us find the meaning of a difficult word.
Request for synthesising	Request to give an overview of the session(s)	Tutor: Ok, can anyone repeat what we have done in this session?
Providing judgement of learning	Expression of understanding or confusion	Tutee: I don't understand it.
Monitoring progress	Reflecting on the progress made (i.e., alignment or deviations from the planning)	Tutor: I notice that we are not progressing well.
Request for monitoring progress	Request for reflection on the progress made (i.e., alignment or deviations from the planning)	Tutor: Ok, what have we done already?
Off-task behaviour	Tutee is not involved in the tutoring process	Tutee is looking outside.

7 General conclusion and discussion

Chapter 7
General conclusion and discussion

Abstract

In the light of two main research goals (i.e., assessing self-regulated learning in late primary education and exploring the impact of student tutoring as a method to improve self-regulated learning), five empirical studies were presented in this dissertation. The aim of this concluding chapter is to provide a comprehensive discussion of the results obtained in the different empirical studies (see chapter 2 to 6). Furthermore, limitations related to the research design, study sample, study variables, measurement instrument and data analysis are considered. In line with these limitations and possible explanations of the current findings, suggestions for future research are formulated. Besides stipulating implications for theory and research, this dissertation concludes with implications for educational practice and policy.

Introduction

Self-regulated learning (SRL) is often and increasingly embraced as a research topic in educational research. Based on a literature review several challenges were identified within the research field of SRL. Notwithstanding the more recent evidence of primary school children's capability to display and acquire SRL (Veenman, van Hout-Wolters, & Afflerbach, 2006; Whitebread et al., 2009; Whitebread & Pino Pasternak, 2010) and the call for promoting SRL early in students' school careers (Blair & Peters Razza, 2007; Dignath, Buettner, & Langfeldt, 2008; Perry, Phillips, & Dowler, 2004; Veenman & Spaans, 2005), research regarding primary school children's SRL remains limited (Whitebread et al., 2009; Winne & Perry, 2000). Alongside the long held belief that younger students were unable to self-regulate their learning, this empirical shortage is also connected to the current need for valid measures of children's SRL (Boekaerts & Corno, 2005; Winne & Perry, 2000). Consequently, more research detailing primary school children's SRL is requested (Malmberg, Järvelä, & Kirschner, 2014; Perry, Thauberger, & Hutchinson, 2010). Given the importance of SRL in the transition from primary to secondary education, especially research in the age group of late primary school children is wanted (Cleary & Chen, 2009; Dembo & Eaton, 2000). Further, also research regarding specific groups, such as students from low socio-economic and/or immigrant backgrounds, is underexposed in contemporary research (Pintrich & Zusho, 2007).

Moreover, stemming from the observations that a substantial group of learners encounter difficulties in regulating their learning or using strategies in a high-quality way (Annevirta & Vauras, 2006; Glogger, Schwonke, Holzaepfel, Nueckles, & Renkl, 2012; Pintrich, 2002, 2004; Schunk & Ertmer, 2000; Winne & Nesbit, 2009; Zimmerman, 2002) and that teachers' efforts regarding SRL remains rather limited or insufficient (Kistner et al., 2010; Moos & Ringdal, 2012; Spruce & Bol, 2014), research focusing on how training and intervention can support children to develop and ameliorate their SRL, is needed. In this respect, different approaches have been examined: classroom-based training (e.g., Perels, Dignath, & Schmitz, 2009; Stoeger & Ziegler, 2008), computer-based training (e.g., Graesser, McNamara, & VanLehn, 2005; Jacobse & Harskamp, 2009; Kramarski & Gutman, 2006), and school-based programmes (e.g., Cleary & Zimmerman, 2004). However, to our knowledge, the potential of enhancing SRL by means of student tutoring, a method in which children receive guidance in small groups from higher education students, has not been explored yet. As close and individualised guidance seems to be preferable in promoting SRL (Butler, 2002a; Veenman et al., 2006), student tutoring might be an interesting approach to provide students with such individual support. Despite the promising potential offered by student tutoring to stimulate SRL, the effects and underlying assumptions have yet to be fully examined, as research on student tutoring is underexposed in the research field of tutoring, especially with SRL as curriculum of tutoring. Furthermore, the research literature increasingly argues that researchers should move beyond the focus of examining only the effects of interventions towards also addressing process data, since this can deepen our understanding of why educational interventions are effective or not (Pressley, Graham, & Harris, 2006).

Based on the challenges in the literature, two main research goals were targeted in this dissertation. The first main goal was *assessing SRL in late primary education*. Within this goal, two subgoals can be distinguished:

(1) In order to be able to document students' initial use of SRL and to investigate possible intervention effects, the *development of instruments* to measure late primary school children's SRL (Boekaerts & Corno, 2005; Winne & Perry, 2000), was our first subgoal. In line with the advice to combine multiple means of operationalising and measuring SRL (Boekaerts & Corno, 2005; van Hout-Wolters, 2009; Veenman, 2005; Zimmerman, 2008), a self-report questionnaire to assess children's perceived use of self-regulatory learning strategies and a think-aloud protocol to assess their actual use of these strategies concurrent to task execution were developed.

(2) In line with the request for research detailing late primary school children's spontaneous use and development of SRL (Malmberg et al., 2014; Perry et al., 2010), our second objective was to gain insight into late primary school children's SRL by conducting *baseline assessment of SRL* among this age group. In addition, we specifically focused on at-risk children due to their low socio-economic and/or immigrant backgrounds, as limited studies on SRL are available among this target group. Our choice to focus on this target group is also motivated by the findings that these students are underperforming in the Flemish educational system. As SRL can have the power to enhance students' performance, providing additional instruction and support regarding SRL can be fruitful to strengthen their educational position. In this respect, it is important to first document their SRL.

The second main goal of the dissertation, namely exploring the impact of student tutoring as a method to stimulate SRL, was further specified by two subgoals:

(3) Notwithstanding the numerous effect studies on peer tutoring, research on the effect of student tutoring remains rather scarce. Additionally, most of the previous studies on student tutoring have been focused on specific subjects as the curriculum of tutoring (Gordon, Morgan, O'Malley, & Ponticell, 2007; Topping & Hill, 1995). As such, the third subgoal was to *study the effectiveness of student tutoring on at-risk late primary school children's SRL*, which is also an innovative approach within the research on SRL interventions.

(4) Given the original one-sided focus on effect studies in the student tutoring literature, we also aimed *to investigate the tutoring processes during student tutoring focusing on SRL.*

In line with the two main research goals, the subsequent paragraphs provide a discussion of the main results. A tabular overview of the obtained results, study limitations, suggestions for future research and implications, are given in the appendix.

Overview and discussion of the main results

Assessing SRL in late primary education

Elaboration on SRL instruments used in the pilot study

In the pilot study (see chapter 2), we opted for three different measures to assess late primary school children's SRL, as the existing assessment methods were not aimed at the full spectrum of SRL (Butler, 2002b; Dowson & McInerny, 2004; Schellings, 2011; Wirth & Leutner, 2008). More concretely, two self-report questionnaires ('Learning Motivation Test' (LMT); Miedema & de Vos, 2004 and 'Jr. Metacognitive Awareness Iventory' (Jr. MAI); Sperling, Howard, Miller, & Murphy, 2002) were combined with the Self-Regulated Learning Interview Schedule (SRLIS; Zimmerman & Pons, 1986). Although these measures have their merits, some specific problems were associated with them. First, the LMT reflects a quantitative perspective on motivation as the measure only provides information regarding to what extent students are motivated. Contemporary research on motivation, however, advocates that it is not merely the quantity, but also the quality of motivation that will predict students engagement in learning and deep-level engagement (Ryan & Deci, 2000; Vansteenkiste, Lens, & Deci, 2006). Second, although the underlying framework of the Jr. MAI (i.e., framework of Brown (1978)) is well-established in the research on metacognition, some inconsistencies concerning the psychometric characteristics of the instrument can be found when tracking back the validation of this scale (e.g., cross loadings, ignorance of initial obtained factor structure of preceding factor analyses). Third, using the different scales alongside each other may cause measurement difficulties as the scales are developed from different theoretical perspectives, use different instructions and response formats, and have different psychometric properties (Dowson & McInerny, 2004; Muis, Winne, & Jamieson-Noel, 2007). In order to overcome these shortcomings related to self-report questionnaires, a comprehensive set of scales grasping the multi-component character of SRL is needed (Cascallar, Boekaerts, & Costigan, 2006; Wirth & Leutner, 2008). To our knowledge, this kind of instrument to assess SRL among late primary school children is, however, not available in the literature so far.

Finally, the SRLIS (Zimmerman & Pons, 1986) is a more qualitative instrument allowing students to report in a more open-ended way on their strategy use instead of rating the frequency of their use of a predefined set of strategies in questionnaires (Boekaerts & Corno, 2005; Scott, 2008; Wolters, Bezon, & Arroyo-Giner, 2011). However, the SRLIS is also a self-report measure in which students retrospectively report on their strategy use and consequently present more information on students' perception of their strategy use rather than on their actual use (Boekaerts & Corno, 2005; Veenman, 2005; Winne & Perry, 2000). Although the SRLIS has been extensively used in prior research (Winne & Perry, 2000), it was observed that the strategies reported by the students were strongly elicited by the specific selection of learning contexts and the related questions presented in the SRLIS. For example, two of the eight learning situations in the interview explicitly questioned students about their strategies to self-evaluate their learning after finishing a test or task. These explicit questions might increase the possibility that students report more self-evaluation strategies than when not triggered by the question. Finally, a remark can be made regarding the coding categories of the SRLIS, which are not fully in line with contemporary theoretical categorisations of SRL. For example, rehearsal strategies are divided over two coding categories (i.e., 'reviewing records' and 'rehearsing and memorising'), while elaboration strategies are not explicitly addressed in the coding scheme.

Stemming from these comments and shortcomings, the development of new instruments was perceived as a prerequisite to conduct further research on SRL. In line with the recommendations to combine different types of measuring methods (Pressley et al., 2006; Schellings & van Hout-Wolters, 2011; Veenman, 2005; Winne & Perry, 2000), a self-report questionnaire to assess late primary school children's perceived use of SRL and a think-aloud protocol to measure their SRL during task performance were developed.

Development of Children's Perceived use of Self-Regulated Learning Inventory (CP-SRLI)

Chapter 3 reports upon the development and validation of a comprehensive and coherent set of scales to assess late primary school children's perceived use of self-regulatory learning strategies in academic homework contexts, i.e., the Children's Perceived use of Self-Regulated Learning Inventory (CP-SRLI). A multistep process was followed to develop the questionnaire (Downing, 2006; Schmeiser & Welch, 2006; Worthington & Whittaker, 2006). First, the model of Pintrich (2000) served as blueprint for the development. As described in chapter 3, this framework was accustomed to our target group based on a thorough literature review of SRL research and developmental research regarding SRL. The adjusted framework entailed nine components: task orientation, planning, monitoring, motivation, learning strategies, self-efficacy for self-regulated learning, motivational strategies, persistence, and self-evaluation. For each component, items were constructed resulting in an intial item pool of 99 items. Subsequently, the items were reviewed by an expert and a teacher panel to review whether the set of statements were consistent with the underlying framework, worded clearly, and suitable for late primary school children. To advance the validity of the self-report items (Karabenick et al., 2007; Woolley, Bowen, & Bowen, 2004, 2006), cognitive interviews with children were conducted. Based on these review processes, the items were refined and some additional items were added, resulting in 109 items. These items were administered to a first sample of 967 fifth and sixth graders. The (uni)dimensionality of each item set related to the nine components was assessed separately using parallel analysis and exploratory factor analysis (Dowson & McInerny, 2004; McCardle, Hadwin, & Winne, 2012). The factorial validity was supported by confirmatory factor analysis performed on a second independent sample, consisting of 723 fifth and sixth graders. Finally, factor invariance across gender was also establised. The final version of the CP-SRLI comprised 75 items divided over 15 subscales (see Appendix of chapter 3). The internal consistency of the (sub)scales was acceptable to good.

The obtained factor structure of the CP-SRLI was largely in line with the hypotheses formulated based on the literature. However, some dissimilarities were also found. In line with the hypotheses we found: (1) a one-factor model for 'task orientation', 'planning', 'monitoring', 'persistence', and 'motivational strategies' (e.g., Broekkamp & van Hout-Wolters, 2007; Butler & Cartier, 2004; Desoete, 2008; Meijer, Veenman, & van Hout-Wolters, 2006; Pintrich, 2004; Schneider, 2008; van Hout-Wolters, Simons, & Volet, 2000; Veenman, 2005; Wigfield, Klauda, & Cambria, 2011; Wolters, 2003), (2) a two-factor model for 'self-evaluation' comprising 'self-evaluations of learning outcomes' on the one hand, and 'self-evaluations of learning processes' on the other hand (e.g., Meijer et al., 2006; van Hout-Wolters et al., 2000), and (3) a four-factor model for 'motivation' (Deci & Ryan, 2000). Regarding the latter, the confirmation of the four types of motivation distinguished by the self-determination theory (i.e., external regulation, introjected regulation, identified regulation, and intrinsic motivation; Deci & Ryan, 2000) also adds to the recent research field applying the self-determination theory to explore motivation in educational contexts among primary school children (Aesaert, van Braak, van Nijlen, & Vanderlinde, 2015; De Naeghel, Van Keer, Vansteenkiste, & Rosseel, 2012).

The traditional categorisation of cognitive learning strategies in rehearsal, organisational, and elaboration strategies (Weinstein & Mayer, 1986) was not retained. The categorization of deep-level learning strategies and surface-level learning strategies (Alexander, 2004; Leutner, Leopold, & Den Elzen-Rump, 2007) seemed to better reflect the cognitive learning strategies of late primary school children. Further, in contrast to prior studies which found a unidimensional factor structure for items tapping into students' self-efficacy for self-regulated learning (Bandura, 2006; Usher & Pajares, 2008), the current analyses revealed a separate scale for self-efficacy beliefs regarding cognitive and metacognitive aspects on the one hand, and for self-efficacy beliefs regarding motivational aspects on the other hand. The emergence of 'self-efficacy regarding motivation' as a separate factor served as an indication that self-efficacy beliefs regarding motivation might be critical to understanding students' engagement of SRL. This finding is also in line with increasing research findings on the importance of motivation within SRL (Wolters et al., 2011; Zimmerman, 2011; Zimmerman & Schunk, 2008).

Building upon the importance of context-specific assessment of SRL (Cleary, Callan, & Zimmerman, 2012; Hadwin, Winne, Stockley, Nesbit, & Woszczyna, 2001; McCardle & Hadwin, 2015; McNamara, 2011; Patrick & Middleton, 2002; Veenman et al., 2006), the CP-SRLI focuses on the context of academic homework. However, academic homework reflects a variety of tasks which can be applied across domains, and consequently asks repondents to aggregate responses across different types of tasks (Boekaerts & Corno, 2005; McNamara, 2011; Patrick & Middleton, 2002; Veenman, 2011b). In this respect, the second instrument developed in the present dissertation , namely a think-aloud protocol, is complementary as it entails more specific tasks.

Development of think-aloud protocol

During the think-aloud sessions students were asked to individually perform two different task presented as homework assignments of their own classroom teacher, i.e., solving a Sudoku and studying an informative text. The choice of these two tasks was grounded in the aims to allow task-specific activities by maximizing the differences in tasks and domains and to opt for tasks within two domains that are frequently addressed in SRL research (i.e., mathematics and reading and learning from text) (van der Stel & Veenman, 2010; Whitebread & Pino Pasternak, 2010).

In order to analyse students' activities performed during the think-aloud tasks, a coding scheme was developed. The development of this scheme was both theory- and data-driven. First, the theoretical framework of Pintrich (2000, 2004) adjusted for our age group - which also served as blueprint for the development of CP-SRLI - was used for the development of the coding scheme. This was in order to improve the coherence of both instruments. Second, in line with Chi (2006), a thorough analysis was executed identifying a range of possible activities which could be displayed during performing the think-aloud task. These activities were categorised according to the nine components of the adjusted theoretical framework (i.e., task orientation, planning, motivation, self-efficacy for self-regulated learning, monitoring, learning strategies, persistence, motivational strategies, and self-evaluation). The majority of these components were applicable to the think-aloud data and subcategories within the coding scheme could generally be aligned to individual CP-SRLI items of the subscales. However, some differences were also noted. First, given the fact that it is difficult to capture students' persistence throughout a task by means of single units or statements, no specific units regarding the component 'persistence' could be detected in the data. Similarly, students did not verbalise their motivational reasons to engage in the learning tasks. Although some motivational aspects were incorporated in the coding scheme (e.g., expressions regarding task interest or difficulty, motivational strategies), information regarding their learning motivation as assessed in the CP-SRLI (i.e., external regulation, introjected regulation, identified regulation and intrinsic motivation) could not be gathered. Third, an additional main category was added based on the data, namely 'adjusting strategy use'. Fourth, regarding cognitive learning strategies, the coding scheme categorises the learning strategies according to the categorisation of rehearsal, organisational, and elaboration strategies (Weinstein, Jung, & Acee, 2011; Weinstein & Mayer, 1986), while in the CP-SRLI the two latter categories are reflected in the 'deep-level strategies' – scale.

In sum, the coding scheme entails ten main categories (see Appendix in chapter 4): task orientation, planning, self-efficacy, rehearsal strategies, organisational strategies, elaboration strategies, motivational strategies, monitoring, adjusting strategy use, and self-evaluation. These are further specified by multiple subcategories and specific indicators of self-regulatory activities or processes at the lowest operational level. This structure allows the user to analyse SRL at various grain sizes as both micro-level as well as macro-level processes are distinguished (Greene & Azevedo, 2009). Further, as reported on in chapter 4 and 5, high interrater reliability was found and TAP has proved to be a valuable method to gain more objective and detailed information about late primary school children's SRL (Greene et al., 2011; Veenman, 2011b).

Baseline assessment of at-risk late primary school children's SRL

Based on the abovementioned developed instruments, a baseline assessment was conducted aimed at gaining insight in late primary school children's SRL with a low socio-economic and/or immigrant background in particular. First, based on the analysis reported in chapter 3, significant correlations between the different (sub)scales were found, corroborating that SRL is a multi-faceted and complex process (Boekaerts & Cascallar, 2006; Dinsmore, Alexander, & Loughlin, 2008; Pintrich, 2004; Zimmerman, 2002). These analyses also showed that external regulation did not significantly correlate with the majority of the other subscales. Second, based on the descriptive results of CP-SRLI provided in chapter 3 and the pretest of chapter 5, children's self-regulatory strategy use during academic homework can generally be described as follows. Before commencing on the task, they commonly orientate themselves towards the task and make a plan. Identification with the personal significance and value of an activity (i.e., identified motivation) followed by intrinsic motivation seem to be the most important reasons to engage in learning behaviour. They also feel more competent to regulate their motivation than to regulate their learning processes regarding cognitive and metacognitive aspects. During task performance, they monitor their learning and use motivational strategies to a moderate or a relatively high extent. They also report high persistence. Moreover, they opt more often for superficial than for deep-level learning strategies. After task performance, they more frequently evaluate their performance than their learning processes.

It is important to link this rather optimistic picture of students' SRL obtained through the self-report measure to students' actual use as reflected in the results of the think-aloud protocol (TAP) analysis provided in chapter 4 and 5. First, in line with the results of CP-SRLI and prior research evidence (Annevirta, Laakkonen, Kinnunen, & Vauras, 2007; Cooper & Corpus, 2009; Kron-Sperl, Schneider, & Hasselhorn, 2008; Neuenhaus, Artelt, Lingel, & Schneider, 2011; Perry et al., 2010; Schneider, 2008; Whitebread et al., 2009; Whitebread & Pino Pasternak, 2010; Wigfield et al., 2011), the results of TAP confirm that primary school children are capable of performing SRL. Nonetheless, in-depth analysis of TAP indicates that the strategies are performed on a rather basic, superficial level and not yet sophisticated or academically oriented, which was also found in the qualitative analyses of the SRLIS in chapter 2. These results confirm that students often fail to display high-quality SRL (Boekaerts, 2007; Glogger et al., 2012; Merchie & Van Keer, 2014b; Winne & Nesbit, 2009).

Below, we discuss the results regarding the metacognitive, cognitive, and motivational aspects of SRL in more detail. Regarding the *metacognitive aspects of SRL* the TAP results show a predominant use of monitoring activities, followed by adaptive strategy use across both tasks. In contrast, task orientation, planning, and self-evaluation were observed to a limited extent and on an irregular basis. The dominance of monitoring is in line with prior studies and can be explained by the fact that monitoring is inherent to every part of the learning process, while orientation, planning, and evaluation strategies are applied mostly either before or after task performance (Azevedo, Winters, & Moos, 2004; De Backer, Van Keer, & Valcke, 2012; Meijer et al., 2006; Moos & Azevedo, 2009). The finding that students were mainly prone to SRL processes during the performance phase can also be aligned to the finding that primary school teachers are especially inclined to encourage students' SRL during the monitoring phase of learning events rather than in the planning and evaluation stages (Spruce & Bol, 2014). Furthermore, the finding that planning and self-evaluation was actually performed on a limited basis adds strength to our hypothesis that the high frequency of self-reported planning and self-evaluation strategies during the SRLIS interview in the pilot study (see chapter 2) are mainly elicited by the selection of learning situations and related questions in the SRLIS (see 'elaboration on SRL measurement instrument used in pilot study').

The subcategories of the TAP coding scheme provide a more detailed view, showing that the metacognitive activities were performed on a rather basic level. For instance, activities regarding task orientation mainly reflected detecting task demands and little attention was paid to activating prior knowledge or becoming aware of one's own task perceptions. Moreover, in detecting task demands, students merely routinely read the task instructions without processing the demands thoroughly by, for example, paraphrasing the task instructions or examining examples provided in the instructions. When monitoring learning, students mostly focused on monitoring comprehension during solving the Sudoku and interim checking during text studying, while other types of monitoring (e.g., monitoring of progress or affective monitoring) were often ignored. In the rare case that students evaluated their learning, they almost exclusively evaluated the learning outcome and hardly ever reflected on the learning process. This primary focus on learning outcomes was also found in the CP-SRLI results as described above. Further, the metacognitive activities, like task orientation, monitoring, and self-evaluation, were generally more frequently applied during solving the Sudoku than during text studying, confirming that metacognitive activities can vary across tasks and domains (Alexander, Dinsmore, Parkinson, & Winters, 2011; Braten & Samuelstuen, 2004; Hadwin et al., 2001).

Concerning the *cognitive learning strategies* applied during text studying, the TAP results reveal that students studied in a rather one-sided manner. They mainly focused on surface-level processing strategies aimed at basic memory or comprehension of the text (e.g., re-reading and reciting). Further, they applied relatively few deep-processing strategies aimed at transformation or application of information and struggled to implement those strategies in a qualitative manner (e.g., distinguishing between important and less important information, making connections with prior knowledge) (Broekkamp & van Hout-Wolters, 2007; Meneghetti, De Beni, & Cornoldi, 2007; Merchie & Van Keer, 2014b). These results are in line with the CP-SRLI results, revealing students' preference for surface-level learning strategies.

Beside the metacognitive and cognitive aspects, the results of the think-aloud protocol analysis reveal limited *motivational aspects of SRL*. Students hardly ever (1) expressed their task perception, (2) reflected on their competence to perform the task, (3) used motivational strategies to regulate their motivation, or (4) expressed affective reactions after task performance. These results are in line with prior research using think-aloud protocols during learning from text (Merchie & Van Keer, 2014b). It can be hypothesised that motivational processes operate on a more unconscious level, making these processes less accessible for verbalisation of the students (Bannert & Mengelkamp, 2008).

Next to the discussion of the occurrence of the different SRL strategies, the TAP results illustrated the *individual variability* in students' SRL processes (Annevirta & Vauras, 2006; Greene & Azevedo, 2009; Pintrich, 2000; Winne, 2005; Zimmerman, 2002). Some preliminary indications of which factors might underlie these individual differences were found in chapter 3 and 5. In chapter 3, analyses regarding gender differences revealed that boys reported applying the following strategies less frequently than girls: task orientation, planning, surface and deep-level strategies, persistence, monitoring, and product evaluation. They also reported feeling less competent to regulate their learning. In addition, boys reported themselves to be more motivated by external reasons, while girls were more motivated by the personal relevance of learning tasks. In chapter 5, four motivational profiles (i.e., high quantity motivation group, moderate quality motivation group, low quantity motivation group, good quality motivation group) were found based on a cluster analysis on motivation and self-efficacy subscales. Based on the results regarding the relationship between students' motivational profiles and SRL revealed that students with a low quantity motivation profile significantly reported lower scores on the metacognitive and cognitive variables of the CP-SRLI (see chapter 5).

In chapter 4 *longitudinal data* were also provided by following up fifth graders during two successive school years. The analyses in this chapter confirm the individual variability in the development of SRL and simultaneously show that – with the exception of a significant increase in 'making notes' and some subtle, minor qualitative improvements - students' SRL generally remained stable over time. It was expected, however, that late primary school children undertook important steps in developing a broader and more sophisticated repertoire of SRL strategies to handle the upcoming increasing demands in secondary education (Cleary & Zimmerman, 2004; Hamman, Berthelot, Saia, & Crowley, 2000; Meneghetti et al., 2007). At the same time, research reports that many students exhibit declines in their perceptions of competence and intrinsic desire to engage in learning when they proceed through primary school and further education (Corpus, McClintic-Gilbert, & Hayenga, 2009; Fredricks & Eccles, 2002; Usher & Pajares, 2008). These motivational processes may have important implications for the choices students make about becoming strategically and (meta)cognitively engaged in their learning (Urdan & Midgley, 2003; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004; Zimmerman, 2011). It can be assumed that these opposing forces, in combination with the observation that classroom practice is mostly not favourable for stimulating SRL, might be responsible for the absence of clear improvements in students' naturally developing SRL (Cleary & Chen, 2009; Wood & Tanner, 2012).

Concluding thoughts

In conclusion, regarding the assessment of SRL, the results corroborate that by using a multi-method approach, researchers can profit from the power of different methods to obtain a broader picture and deeper insights into learners' self-regulated learning strategies. Notwithstanding the fact that some similarities were observed (i.e., regarding the use of learning strategies and self-evaluation), the discrepancy between the self-report and think-aloud data confirms the tendency of students to overestimate their actual strategy use in self-reports (Boekaerts & Corno, 2005; Cromley & Azevedo, 2006; Schellings & van Hout-Wolters, 2011; Veenman, 2011a). However, the value of self-report data should be acknowledged as well, as it provides insight into self-perceived propensities of using a particular tactic or strategy (Perry & Winne, 2006; Pintrich, 2004; Richardson, 2004; Zimmerman, 2008). As students monitor their learning in relation to these personal perceptions of their learning approach and its outcomes (Winne & Jamieson-Noel, 2002), misinterpretations of SRL (i.e., overestimation) can result in persistent use of inadequate strategies, as they will not experience the need for more productive forms of SRL (Winne, 2004). Although the TAP has important assets in uncovering ongoing SRL, our results based on this measure show that motivational aspects of SRL were difficult to capture by means of this method. In this respect, the CP-SRLI can complement the TAP to assess motivational aspects of SRL.

Further, the descriptive and longitudinal findings in the present dissertation confirm that children from low socio-economic and/or immigrant families encounter difficulties regulating their learning as their strategy use was generally characterized as basic and superficial. Moreover, their self-regulatory strategy use remained rather stable over time. This indicates that in many cases SRL does not develop spontaneously and that additional training and instruction is needed to initiate, improve, or sustain these desirable skills (Askell-Williams, Lawson, & Skrzypiec, 2012; Boekaerts, 1997; Dembo & Eaton, 2000; Schneider, 2008; Schunk, 2001; Schunk & Ertmer, 2000; Weinstein, Husman, & Dierking, 2000). Moreover, the observed individual variability underlines the need to take the individual differences into account when supporting SRL (Butler, 2002a; Veenman et al., 2006; Zimmerman, 1990).

Exploring the impact of student tutoring as a method to stimulate SRL

The objective to explore the impact of student tutoring as a method to stimulate SRL is grounded in the premise that specific characteristics of student tutoring are in line with learning environments conducive for SRL. First, within the small group setting of student tutoring, tutors are presumed to more easily track individual students' current knowledge and skills, tailor the tutoring session to tutees' personal needs, and establish the tutees' zone of proximal development, resulting in more individualised support (Gordon et al., 2007; Graesser & McNamara, 2010; Lepper & Woolverton, 2002). Second, within a student tutoring setting, learners are invited to play a more active role in their learning and to take responsibility over their learning processes, accompanied by continuous and immediate feedback from tutors (Gaustad, 1992; Gordon et al., 2007; Topping & Ehly, 2001). Third, the opportunity to build a trusting relationship with a tutor who holds no position of authority, receiving more praise and encouragement than in whole-class instruction, together with the additional attention itself, may be beneficial for motivational aspects of SRL (Gaustad, 1992; Karsenty, 2010; Topping & Ehly, 2001).

Based on the study reported on in chapter 6, some of these premises were indeed confirmed. First, the results indicated that in the tutoring sessions there was room for the social and motivational component of tutoring (Graesser & McNamara, 2010; Lepper & Woolverton, 2002; Topping & Ehly, 2001). Second, in contrast to prior studies pointing at a clear dominance of the tutor (Berghmans, Neckebroeck, Dochy, & Struyven, 2013; Chi, Siler, Jeong, Yamauchi, & Hausmann, 2001; Graesser, Person, & Magliano, 1995; VanLehn, Siler, Murray, Yamauchi, & Baggett, 2003), a remarkable and positive finding in the student tutoring program in the present dissertation was that tutor and tutee contributed equally to the tutoring dialogue. This result, in combination with the finding that tutees asked more questions in tutoring compared to a whole-class setting (Chi et al., 2001; Graesser & Person, 1994), supported the assumption that the tutoring setting offered tutees more opportunities to engage more actively. As such, the tutoring sessions could generally be typified as interaction-centred sessions, with tutors trying to get the students to do the acting and talking through questioning and facilitation and tutees engaging in providing explaining and answers. These findings are in clear contrast to prior studies which reported giving explanations as the main responsibility of tutors. Our divergent finding might be explained by the explicit focus on SRL during tutoring and the prior training our tutors received. In the training it was stressed that tutors should approach their tutees as active participants and they should regard their tutoring role as a coach rather than instructor. This might have influenced tutors' perceptions of their role and subsequently their choice of tutoring behaviours (Roscoe, 2014). The current findings also illustrated that with adequate training unskilled student tutors can provide quite high quality tutoring and overcome some typical drawbacks of novice tutors, such as a strong didactic style.

Notwithstanding the fact that a more interactive style of tutoring, as in the current study, has been found to be more beneficial for learning than adopting a directive and didactic style (Chi et al., 2001; VanLehn et al., 2003), no strong unequivocal and convincing evidence of the effectiveness of student tutoring to promote SRL among late primary school children was found (see chapter 2 and 5). Only some indications of beneficial effects of the student tutoring were found. More concretely, teacher ratings in the intervention study (see chapter 5) showed a positive evolution from pre- to posttest. Further, while the intervention did not show positive effects for the majority of the participating students, positive effects were found for the most at-risk students with a low quantity motivation profile regarding their planning, intrinsic motivation, self-efficacy regulation, and persistence. These positive effects appear to be mainly regarding motivational aspects of SRL, which is parallel with the findings in the pilot study showing an increase in sixth graders' learning motivation alongside an increase in metacognitive awareness. Also regarding the cognitive aspects of SRL some positive, but non-significant, trends were observed. First, a marginal significant positive evolution regarding fifth graders' self-reported use of overt and covert rearrangement of instructional material to improve learning (i.e., 'organising and transforming' subcategory of SRLIS, see chapter 2) was found. Based on the descriptive data from the think-aloud analysis reported in chapter 5, a positive trend was also observed regarding students' use of organisational strategies during the think-aloud tasks. This observation, in addition to the finding that students also showed spontaneous improvements regarding organisational strategies (see chapter 4), might indicate that cognitive learning strategies are more receptive to training than metacognitive strategies (Lavery, 2008). Further, based on the qualitative analysis of the SRLIS in the pilot study, after the intervention students reported more refined and profound approaches towards 'self-evaluation', 'goal setting and planning', 'environmental structuring' and 'rehearsing and memorising'. This kind of qualitative analysis was, however, not performed regarding the think-aloud data in chapter 5. In this intervention study only the occurrence of the strategies was taken into account to investigate the effectiveness of the intervention. A more qualitative analysis of the think-aloud data (e.g., exploring whether students' note taking was of higher quality after the intervention or whether students were able to better distinguish main from side issues in a text after the intervention) would be worthwhile to provide a more nuanced picture of the impact of the intervention, as the longitudinal data in chapter 4 also showed that improvements in SRL tend to be more of a qualitative than quantitative nature.

The rather disappointing results regarding the effectiveness of student tutoring on at-risk students' SRL are in contrast to the generally positive outcomes for tutees reported in prior tutoring studies (Cohen, Kulik, & Kulik, 1982; Ritter, Barnett, Denny, & Albin, 2009; Topping & Hill, 1995). It should, however, be noted that these positive findings of tutoring predominantly stem from studies focusing on subject-specific content, and not on SRL. Moreover, prior studies show that not all tutoring interventions lead to positive effects (e.g., Smith, Cobb, Farran, Cordray, & Munter, 2013; Vadasy, Jenkins, Antil, Wayne, & O'Connor, 1997) and that the effect size of the impact of student tutoring varies considerably across studies (Gordon et al., 2007; Ritter et al., 2009). In respect, Ritter et al. (2009) state that many of the individual studies, standing alone, do not show significant program effects, but when conducting a meta-analysis the overall effect is relatively large and statistically significant. Further, in this dissertation it was explicitly intended to focus on the impact on students' SRL, as the assessment of SRL as such is often overlooked in studying the effects of SRL interventions (Veenman et al., 2006). Consequently, domain-specific learning performance was not incorporated as an outcome variable. This might, however, have been interesting to more fully assess the impact of student tutoring, as it is not uncommon that SRL training results in higher learning performance regarding the domain in which the SRL was embedded, but effects on SRL skills themselves remain limited (Hattie, Biggs, & Purdie, 1996).

Although further research is needed to uncover these unexpected results more fully (for a discussion see further in this concluding chapter), several interesting findings already emerge from the student tutoring process study (see chapter 6), illuminating the results of the intervention study and simultaneously confirming the value of process-oriented analysis. First, a focus on strategy knowledge was found and mainly on declarative and procedural knowledge and less on conditional knowledge, as tutors rarely provided explicit instruction or a rationale (see table 2 of chapter 6) to inform students on when and why a certain strategy could be helpful. However, highlighting the added value of SRL strategies is considered as an important strategy to enhance transfer of the instructed strategies (Cooper & Corpus, 2009; de Boer, Donker-Bergstra, Kostons, Korpershoek, & van der Werf, 2012; Kistner et al., 2010; Leutner et al., 2007; Paris & Paris, 2001; Veenman et al., 2006).

Second, although it is important to address declarative, procedural, and conditional knowledge when stimulating SRL (Veenman et al., 2006; Weinstein et al., 2000), this should be supplemented with varying and sufficient practice opportunities (Paris & Paris, 2001; Schunk, 2001; Zimmerman, 2000). Based on the results of chapter 6, it was, however, observed that tutees rarely engaged in typical SRL activities, such as goal setting, monitoring comprehension or monitoring their learning process, potentially implying that too little opportunities were provided to apply and practice self-regulatory learning strategies. It is possible that tutors felt that the time was to restricted to offer multiple practice opportunities.

Third, during practice opportunities, it is important that students receive instrumental feedback to increase their accuracy in performing a particular skill or strategy (Perry, VandeKamp, Mercer, & Nordby, 2002; Schunk, 2001; Zimmerman, 2000). Research indicates that effective feedback not only includes information about learners' performance, but also considers clarification of what good performance is (i.e., goals, criteria, standards), information about what students did well, what they need to improve, and steps they can take to close the gap between current and desired performance (Hattie & Timperley, 2007; Nicol & Macfarlane-Dick, 2006). Regarding this matter, it was observed that tutors were more inclined to give performance feedback and rarely provided constructive feedback regarding students' learning processes, while the latter is vital to enhance SRL (Nicol & Macfarlane-Dick, 2006; van den Boom, Paas, & van Merriënboer, 2007).

Fourth, before moving to a phase of co-regulation (i.e., the transitional phase in learners' acquisition of SRL in which the learner begins to take ownership of self-regulatory actions, while still supported by a more capable other), the development of SRL ideally starts with extensive social guidance in which a more capable person provides instruction and models strategy use, while the learner primarily observes as the model demonstrates the use of strategies and verbalises thought processes (i.e., external regulation). However, as mentioned above, tutors in the present dissertation provided limited instruction and also the modelling of strategy use was limited, as tutor-directed actions (i.e., instances where the tutor enacts or demonstrates a particular action) only accounted for a small amount of tutors' actions. Moreover, tutor-directed actions mainly concerned structural-organisational issues and not key SRL processes, such as monitoring comprehension and progress. In contrast, from the onset until the end of the programme, a predominance of co-regulation was observed, minimising students' opportunities to first observe and distinguish the major features of a model's strategies and the consequences of a model's use of these strategies (Zimmerman, 2000). The role of observation and modelling is, however, perceived as a powerful instruction strategy in the development of SRL (Hattie, 2009; Kitsantas, Zimmerman, & Cleary, 2000; Zimmerman, 2000), and younger learners seem to benefit more from modelled demonstrations (Schunk & Ertmer, 2000).

The absence of a clear modelling phase (or external regulation) might also partially explain why no clear evolution towards self-regulation was observed toward the end of the programme (see chapter 6). However, this might also be due to the fact that tutees were possibly not yet ready to proceed to the phase of self-regulation, leaving tutors in their role as co-regulators. To further explore tutees' SRL actions performed during the process study (see chapter 6), we selected some of the main SRL actions and took a closer look at which actions actually preceded tutees' regulatory actions. Figure 1 shows the absolute frequency of the dominant types of tutors' action proceeding self-regulatory behaviour of tutees. Generally, 85.69% of tutees' planning, monitoring, or evaluation actions were proceeded by a tutor action. In most cases, tutees' actions were a response to tutors' explicit request to perform that particular action (e.g. planning as a response to a request for planning) or performed supplementary to a similar tutor action (e.g., judgements of performance were proceeded by feedback provided by tutor). This finding is in line with the statement of Perry et al. (2010), that children's regulation of learning within classrooms and complex tasks is almost never a solo activity, but typically supported through co-regulation. Similarly, Paris and Paris (2001) state that is often necessary to prompt primary school students to use sophisticated learning strategies that would not necessarily occur spontaneously.

So, although it is positive that tutors engaged in an interactive tutoring style resulting in a dominance of co-regulation, they paid comparatively little attention to important principles regarding effective SRL instruction (e.g., modelling, offer multiple practice opportunities). It might be assumed that the observed interactive tutoring style would have been sufficient to achieve gains in lower-level skills (e.g., reading oral fluency, writing) (e.g., Chi et al., 2001), but that additional actions are needed to attain gains in complex and high order skills, like SRL among struggling learners.

In sum, from the onset it was clear that stimulating at-risk students' SRL by means of student tutoring was an ambitious objective. The intervention study showed that this endeavour was even more complex and challenging than originally perceived. Notwithstanding the fact that the tutoring process study has deepened our understanding, it simultaneously underlines the complexity of tutoring processes in which a tutor with his/her specific characteristics interacts with tutees with diverse capabilities, needs, and features - who in their turn interact mutually regarding such a complex content as SRL. Given the frontier nature of these studies, many issues remain unsolved regarding both student tutoring effectiveness regarding SRL and tutoring processes, suggesting the need for further research which is articulated in subsequent paragraphs.

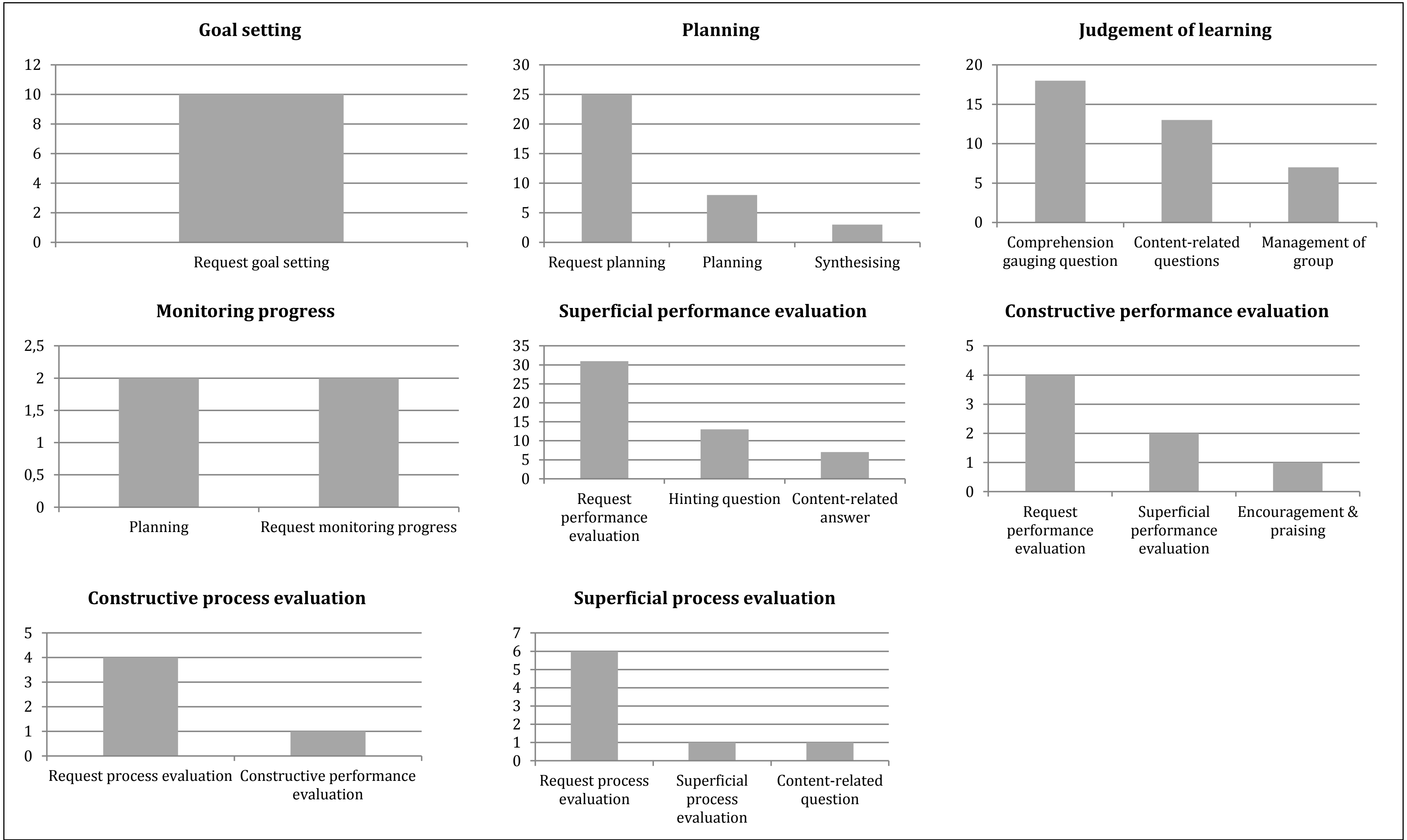

Figure 1. Frequency of the dominant types of tutors' action preceding self-regulatory behaviour of tutees.

Limitations

In the previous chapters, the limitations of the individual studies were discussed and are summarised in the appendix. In the following paragraphs, a general overview of the overall limitations of this dissertation is provided. More particularly, limitations related to the research design, study sample, study variables, measurement instruments and data analysis are discussed. In accordance to these limitations suggestions for further research are formulated.

Research design

First, although some studies in this dissertation adopted a *longitudinal study design* (i.e., chapter 4 and 5), extending these designs by incorporating additional measurement occasions, namely following students through their transition to secondary education, would increase our understanding regarding (1) to what extent students' SRL use is related to the change in learning environment and (2) whether the effects of the student tutoring intervention become apparent or are sustained in the long-term (see also discussion regarding study sample).

Second, future research can explore whether *prolonging* the current *intervention* will yield better outcomes regarding both SRL and performance, both in short-term and long-term effects. For example, Zohar and Peled (2008) found that low-achieving students required a more prolonged period than high-achieving students to achieve substantial gains from SRL training. In this respect, the current tutoring sessions, for example, could be supplemented with additional assignment-assistance tutoring (Hock, Pulvers, Deshler, & Schumaker, 2001) in which students are supported to apply the instructed strategies to authentic homework assignments in order to transfer of the instructed strategies to varying contexts and tasks.

Furthermore, in line with the importance of and increased attention for measuring fidelity of implementation (Gersten et al., 2005; O'Donnell, 2008), in the intervention study (see chapter 5) *treatment fidelity* in the experimental group was assessed in order to determine how well the student tutoring intervention was implemented in comparison with the intended program (O'Donnell, 2008). In further research, however, it might be equally important to consider the instructional practices regarding the research topic *within the control group* as well (Lemons, Fuchs, Gilbert, & Fuchs, 2014; Weis, Bloom, & Brock, 2013). Although no further information regarding the experimental condition was provided to the control schools, they were aware of the general research objectives (i.e., assessing and promoting SRL). As such, the possibility that cooperating in the study evoked higher sensitivity towards the promotion of SRL among control condition teachers should be taken into account (Boekaerts & Corno, 2005). Future research might invest in assessing SRL practices in the control classrooms, for example by administrating the Self-Regulated Learning Inventory for Teachers (SRLIT; Lombaerts, Engels, & Athanasou, 2007), or more preferably by conducting classroom observations (Kistner et al., 2010). As the current student tutoring programme occurred during school hours and in the presence of the classroom teacher, the assessment of SRL practice during daily classroom practice might also be informative to do in the experimental condition.

Study sample

First, in this dissertation we specifically focus on late primary school children with a low socio-economic and/or immigrant background. Given the absence of a comparison group with students from a middle to high socio-economic and native background, we cannot fully state that the current findings regarding the baseline assessment of SRL and the effectiveness of student tutoring on SRL is attributable to either the students' background characteristics or their young age. Verifying the current finding across *different student populations* is therefore needed. Further, in this dissertation, students from a low socio-economic and/or immigrant background were perceived as a rather homogenous group, while this group actually reflect a wide diversity of student characteristics.

In this respect, further research should incorporate additional *personal and background characteristics* to deepen our understanding of individual factors influencing the application and quality of SRL as well as the influence of these characteristics on the responsiveness to the intervention. More concretely, general personal characteristics, such as gender, grade, grade retention, and general achievement level, can be addressed (Moos & Ringdal, 2012; Pintrich & Zusho, 2007). Further, more specific indicators of students' socio-economic and ethnic background should be administered. Regarding this matter, following variables are relevant: home language, social-economic background (i.e., parental education, parental occupation, cultural and educational resources at home), parental support, ethnicity, immigrant status (i.e., first or second generation students) (Agirdag, Van Houtte, & Avermaet, 2012; Frederickson & Petrides, 2008; Hamre & Pianta, 2005; OECD, 2010; Ross, 2009).

Third, it is not only interesting to investigate students from different backgrounds. Including students from different *grade levels*, and students from the first years of secondary education in particular, is important as well. This will increase our understanding regarding the development of SRL and the promotion of SRL for different age groups. In this respect, validating the CP-SRLI in a follow-up study in the first years of secondary education could open up new perspectives for longitudinal research. By doing so, students can be followed with the same instrument when they undergo a significant transition in their educational trajectory, namely from primary to secondary education. Similarly, in chapter 4 the objective was to map out the development of fifth graders' SRL as they approached the important transition towards secondary education by following these students during two successive school years. Extending this longitudinal design by following the students to secondary education would make it possible to investigate whether students react in an adaptive or maladaptive way to the changing learning environment. Moreover, it is argued that the benefits of self-regulatory training efforts in primary school may not lead to immediate results and only become evident during middle-school years and thereafter. In this respect, studying the effects over a longer period (i.e., following students in their transition to secondary school) is advisable.

Fourth, although it is generally believed that training SRL in primary education is more effective than in secondary education because older students are more resistant to changing their learning behaviour (e.g., Dignath-van Ewijk, 2011), there is also some indistinctness regarding this matter. In this respect, we raised the question regarding the ‘critical period’ to stimulate SRL in chapter 5. On the one hand, researchers stress the importance of fostering SRL during primary education in order to prevent children from developing ineffective learning habits (Perry et al., 2004; Postholm, 2010; Stoeger & Ziegler, 2011). On the other hand, however, primary school children are less confronted with complex tasks and demanding learning environments compared to secondary education students. Consequently, they seem to experience the benefits and necessity of applying effective self-regulated learning strategies and to adjust their learning behaviour to a lesser extent. By studying the effects of student tutoring programmes at different grade levels (i.e., late primary education and first years of secondary education), future research could increase our insights into developmental shifts in the efficacy of the interventions.

Further, in the current studies the influence of *tutor characteristics* on the effectiveness of student tutoring and on tutors’ preference of particular tutor moves was not investigated. Based on the literature of both SRL and tutoring (Chi, Roy, & Hausmann, 2008; Dignath-van Ewijk & van der Werf, 2012; Lombaerts, Engels, & van Braak, 2009; Moos & Ringdal, 2012; Roscoe, 2014; Spruce & Bol, 2014), the following variables seems valuable to include in further research: gender, prior tutoring experience and initial state of tutoring skills, beliefs regarding SRL, and tutors' capacity to perform SRL .

A final concern relates to the *small sample sizes* included in the studies reported in chapter 4 and 6. Given the time- and labour intensity of the think-aloud data gathering and analysis (i.e., chapter 4) on the one hand, and video-data analysis of the student tutoring processes on the other hand, only a small number of participants was involved. A small sample size does not only compromise the generalizability of the results, but it also impedes proper hypothesis testing as a risk of type 2 errors (i.e., concluding that there are no differences although in reality differences do occur) cannot be excluded due to insufficient power. However, although we acknowledge that the results of these studies remain rather descriptive and explorative in nature, we believe that they provide valuable input for further research regarding underexposed topics both in the research field of SRL and student tutoring.

Study variables

First, in line with prior studies (De Naeghel et al., 2012; Ryan & Connell, 1989; Vansteenkiste, Sierens, Soenens, Luyckx, & Lens, 2009) and the primary aim to study students' qualitatively different motives for learning, only items regarding external regulation, introjected regulation, identified regulation, and intrinsic motivation were incorporated in the CP-SRLI. However, some researchers argue that in order to be able to conduct a more complete motivational analysis also students' lack of motivation to engage in a learning activity has to be assessed (Ratelle, Guay, Vallerand, Larose, & Senecal, 2007; Soenens & Vansteenkiste, 2005; Vallerand, Fortier, & Guay, 1997; Vallerand et al., 1992). In this respect, furture research can also included the subscale 'amotivation' as an additional type of motivation referring to a situation in which students engage in the activity without any sense of purpose and do not see any relationship between their actions and the consequences of such behavior (Vallerand et al., 1997). This might be of particular relevance given our target group, i.e., students from a lower socio-economic background and/or immigrant background, who experience difficulties in engaging in motivated behavior and investing effort in school (Hornstra, van der Veen, Peetsma, & Volman, 2013).

Second, throughout the dissertation the main focus was on SRL as an outcome variable and no additional measures of academic performance were administered, hampering the linking of SRL to measures of academic performance. Incorporating additional outcomes, like general and task-specific performance outcomes, in further research would be interesting (Schunk, 2008). As such, the validity of both CP-SRLI and the think-aloud protocol can be investigated further by linking general performance outcome and general and task-specific performance to the CP-SRLI scores and think-aloud results respectively (i.e., predictive validity). Further, a more complete view on student tutoring effectiveness could be obtained by also studying the effects on general and task-specific performance. As mentioned before, this is especially warranted since SRL interventions sometimes show no effects on SRL itself, but do on performance (Hattie et al., 1996). Finally, in the process study (see chapter 6), the effectiveness of particular actions or interactions could be explored further by also relating these to students' SRL and performance.

Measurement instruments and data analysis

In line with the recommendation in the literature to combine different methods to assess SRL (Boekaerts & Corno, 2005; Veenman et al., 2006; Zimmerman, 2008), in this dissertation different measures were used to assess students' SRL. While the specific advantages and disadvantages of these instruments were already addressed in the individual studies and the general discussion of the main results, we want to present some additional limitations and suggestions for further research, both regarding the assessment of SRL and analysis of SRL as well as tutoring processes.

First, in the studies reported in chapter 4 and 5, think-aloud data were gathered. During the think-aloud sessions students were asked to perform two tasks, i.e., solving a Sudoku and studying an informative text. While the latter is often used to study students' spontaneous and actual (self-regulatory) strategy use (Greene et al., 2011; Merchie & Van Keer, 2014a; Schellings, Aarnoutse, & van Leeuwe, 2006; van der Stel & Veenman, 2010; Veenman & Beishuizen, 2004), solving a Sudoku might be perceived as a less straightforward choice. This task, however, was chosen for a specific reason, namely to ensure that students could execute the task regardless of the specific curriculum content they already received in their mathematics classes. Nevertheless, it is however possible that students did not perceive this task as a naturalistic or high-stakes task, which might have influenced the adopted self-regulatory strategies during task performance. Therefore, in future research, an *alternative task within the mathematical domain* could be considered, such as word problem solving, which is often used to study metacognitive activities or SRL (Desoete, 2008; Jacobse & Harskamp, 2012; van der Stel & Veenman, 2008). As it is important to select think-aloud tasks that are challenging but comprehensible for students (Bannert & Mengelkamp, 2008; Greene & Azevedo, 2009; van Someren, Barnard, & Sandberg, 1994), it will be necessary to assure that the participants in the study have attained the required underlying mathematical skills to tackle the word problem solving task.

Second, and linked to a previous remark regarding the choice of think-aloud tasks, gathering think-aloud data across *varying contexts and tasks* will further enhance our understanding as to what extent students' SRL is moderated by the context and the task (Alexander et al., 2011; Cleary et al., 2012; Hadwin et al., 2001; McCardle & Hadwin, 2015).

Third, when using think-aloud data, a researcher is not only challenged to develop a reliable coding scheme to accurately capture the breadth and depth of the data, but also to make decisions on how to subsequently analyse the data (Schraw, 2010). In this respect, a more *qualitative perspective* could have been adopted in this dissertation. Although in chapter 4 some qualitative analyses were reported, in chapter 5 only the occurrence of SRL was taken into account. However, changes or developments in SRL strategies are not always manifested in a quantitative way, as illustrated in chapter 4. In other words, rather than using an acquired strategy more frequently, students can apply the strategy more adequately (Malmberg, Jarvenoja, & Jarvela, 2013). Further, a high frequency of strategies does not always reflect more strategic or adaptive learning behaviour (Glogger et al., 2012). For example, if students display a higher frequency of note taking, this does not necessarily reflect improved strategy use as the high frequency can also mean that students are not selective in recording information. In future research, the current TAP can be combined with *examination of traces* to more profoundly investigate the quality of students' strategy use and possible changes herein due to interventions. Traces are relatively unobtrusive measurements representing observable indicators of strategy events as students engage with a task (Braten & Samuelstuen, 2007; Winne & Perry, 2000). For example, highlighted key words in a text or summaries in a notebook are concrete remains of bygone episodes of strategy use and strategic processing (e.g., organisation) (Braten & Samuelstuen, 2007). In the studies of this dissertation, the judgement of the quality of the strategies was mainly based on the different subcategories or specific indicators which represent different qualities (e.g., noting key words in unstructured way versus making a summary). By combining TAP with traces we believe that the quality of the SRL strategies can be more fully assessed by also judging to what extent the applied learning strategy actually fulfils its specific function (e.g., the highlighting of key words resulted in effectively selecting main ideas of a text) (Glogger et al., 2012; Leutner et al., 2007; Schwamborn, Mayer, Thillmann, Leopold, & Leutner, 2010).

Another approach to adopt a more qualitative perspective on the TAP data is to examine the sequence or pattern of activities (Schellings et al., 2006; Winne, 2014). In this respect, analyses allowing the investigation of how students' regulatory activities unfold over time, the analysis of the temporal sequences of students' spontaneous use of SRL, and the identification of patterns in temporally sequenced data can provide more in-depth information and deepen our understanding. A possible and promising technique to do this is the *process mining technique*. This technique derives from the assumption that the temporally ordered event sequence is governed by one or more processes, with each process corresponding to a process model (Bannert, Reimann, & Sonnenberg, 2014). The output from this technique results in a model or 'graph' which consist of events (nodes) and relationships between the events (edges) by taking the relative importance and the temporal order of all events into account (Bannert et al., 2014). Process mining also allows the taking of the process-oriented nature of the TAP data into account to a higher extent. Once patterns are identified by means of process mining, other methods can be used to explore relationships to other variables. Using these process analyses in studies with larger sample sizes could be valuable to further enhance the theory building in SRL (Winne, 2014). Given the benefits of process mining techniques, further research could complement the current analyses reported in chapter 4 and 5 with these analyses. While Bannert et al. (2014) highlight the benefits of process mining techniques for the research field of SRL, they also underline the need for further standardisations and routines to use these methods appropriately.

Fourth, in chapter 4 and 5 it was found that think-aloud protocols seem to be less suitable to capture motivational aspects. As both prior SRL (Wolters et al., 2011; Zimmerman, 2011; Zimmerman & Schunk, 2008) and the current findings indicate the importance of motivation, we advised in chapter 4 to combine think-aloud protocols with other measures, like prospective or retrospective measures (e.g., CP-SRLI). Further research could also combine think-aloud protocols with concurrent measures, like *SRL microanalytic protocols* to assess motivational aspects and processes during task performance. SRL microanalysis refers to a highly specific or fine-grained form of measurement systematically targeting individuals' cognitive, motivational, and metacognitive processes as they engage in learning or performance activities and encompasses elements of both self-report and event measures (Cleary et al., 2012). More concretely, when students engage in a learning activity they are provided with brief, task-specific questions which can be open-ended or close-ended. In order to effectively capture the cyclical nature of SRL, it is typically advised to target as many processes within and across all three phases of SRL as possible (Cleary, 2011). Applied to motivation, (1) targeted forethought processes could include self-efficacy, outcome expectations, reason to pursuit a particular goal and task interest, (2) motivational strategies could be addressed as performance processes, whereas (3) reflection processes can include causal attributions and self-satisfaction (Cleary, 2011; Zimmerman, 2011).

Fifth, in chapter 5 teacher ratings were used as a supplementary measurement of students' SRL. However, a considerable group of teachers reported not feeling competent to provide these judgments, possibly due to a lack of knowledge about how to identify crucial indicators of SRL behaviour and limited opportunities to diagnose or observe students' SRL during classroom practice. Regarding the latter, it might be possible that tutors had a more fine-grained and informed view on students' SRL as they guided the tutees closely during several weeks. So, asking *tutors to rate students' SRL* could provide an additional perspective on students' SRL and the possible effects of student tutoring.

Sixth, in the section 'research design' the suggestion of longitudinal design was made. If more measurement occasions are incorporated, and under the condition of a sufficient sample size, *latent growth curve modelling* might be a suitable method to capture (developmental) changes and to explore group difference. Latent growth curve modelling has been increasingly recognized for its usefulness to identify examination of intraindividual (within-person) change over time as well as interindividual (between-person) variability in intraindividual change. Moreover, this technique allows the detection of both linear and quadratic growth models (Preacher, Wichman, MacCallum, & Briggs, 2008). These features are particularly important as the current findings illustrate the individual variability in SRL and that the development of SRL is not necessarily linear.

A final remark regarding the assessment of SRL, is that in this dissertation and in line with social cognitive research on SRL (Hadwin, Oshige, Gress, & Winne, 2010; Schunk & Mullen, 2013), students' SRL has solely been studied from an individual learner's perspective with the purpose of gaining insight into the process of becoming a strategic learner by actively monitoring and regulating metacognitive, motivational, and behavioural aspects of one's own learning (Hadwin et al., 2010). Although self-regulation research has historically focused on an individual perspective, there is increasing interest in considering these processes at the social level with reference to concepts such as co-regulation and socially shared regulation next to SRL (Grau & Whitebread, 2012; Hadwin, Järvelä, & Miller, 2011; Hadwin & Oshige, 2011; Perry & Rahim, 2011). Whereas co-regulation refers to the situation in which a more capable person supports another person towards appropriation of SRL through calibrated support, socially shared regulation refers to interdependent or collectively shared regulatory processes, beliefs, and knowledge orchestrated in the service of a co-constructed or shared outcome (Hadwin et al., 2011; Hadwin & Oshige, 2011). This topic has been touched upon in the last study in which the shift of self-regulatory ownership was explored (see chapter 6). However, in this analysis only the interactions between tutor and tutee were studied and co-regulation was mainly described and studied as a developmental stage or progression in the SRL of the students (Hadwin & Oshige, 2011). As tutoring occurred in a small group setting, we could also have studied the interaction between the tutees and investigated whether co-regulation or socially shared SRL was present among tutees and whether changes across time could be detected. In this respect and consistent with Perry and Rahim (2011), co-regulation could be operationalised to a situation in which one tutee tried to influence the cognition, motivation, or behaviour of another tutee and socially shared regulation as a situated joint activity in which verbalisations were directed to everyone in the group.

A final limitation and suggestion for further research can be given regarding the analysis of the tutoring processes. In the current analysis tutor and tutee actions were the unit of analysis. Additional coding with a larger grain size, such as supplementing the current coding with *episode coding*, could be valuable. For example, episode coding can enable researchers to investigate to a larger extent the degree of adaptiveness and quality of the provided support (Chi et al., 2001; Graesser, D'Mello, & Person, 2009). In addition, it would also make it possible to asses more specifically whether typical characteristics of learning environments promoting SRL (e.g., open-ended and challenging tasks, providing choices) were present in the tutoring environment (Perry & Rahim, 2011).

Suggestions for future research

In the previous section, suggestions for further research were provided, closely connected to the main limitations of this dissertation. In the present paragraph, we raise additional avenues for future research with the goal of extending and elaborating on the current findings of this dissertation.

Measurement of SRL

First, future research could administer the CP-SRLI questionnaire to a larger sample size and among different grades with the goal of standardising the questionnaire. This would especially increase its practical use in classroom contexts.

Second, while in this dissertation the self-report data of CP-SRLI and think-aloud data have been compared at a descriptive level, a more profound and empirical comparison of both measurement instruments (i.e., convergent validity) could be taken up in future research. This would be of particular relevance as it would explicitly compare different types of measures of SRL in primary school children, which is currently relatively limited (Desoete, 2008; Jacobse & Harskamp, 2012; Merchie & Van Keer, 2014a; Scott, 2008). Besides investigating convergent validity, such research also has the potential to illuminate how these measurements could complement each other and how multiple sources of data could be aligned to construct a comprehensive view on learners' SRL (Schraw, 2010).

Manipulations of the design of the student tutoring programme

To elaborate on the unexpected findings concerning the effectiveness of student tutoring for at-risk fifth and sixth graders' SRL, future research can study the impact of various manipulations of the programme design on the learning gains for the involved actors. As such, future research could gain more insights into the prerequisites of effective student tutoring programmes focusing on SRL.

First, research generally shows that well-structured tutoring programmes and scripting collaborative learning are more effective in promoting deeper learning (Cohen et al., 1982; Gordon et al., 2007; Graesser, D'Mello, & Cade, 2011; Ritter et al., 2009; Rohrbeck, Ginsburg-Block, Fantuzzo, & Miller, 2003; Topping & Hill, 1995). Based on these findings and with the goal to support the tutors in providing instruction on SRL, a tutoring curriculum script was designed. The goal of the curriculum script was primarily to structure the content and goals of the student tutoring sessions, while simultaneously allowing deviations from the script in order to tailor the sessions to tutees' needs by dynamic scaffolding. In this respect, tutors were instructed to provide additional practice opportunities adjusted to students' specific needs and classroom activities. However, the study in chapter 6 demonstrated that during the tutoring sessions the focus was more on strategy knowledge than on the application and practice of SRL. This might be attributed to the presence of a curriculum script. The current curriculum script predefined the main topics of the sessions aligned to the three main components of SRL. For each session specific learning goals were formulated. Furthermore, exercises were provided to introduce and instruct the strategies combined with example exercises to further practice them. To attain adaptive support tutors preferably base their instruction on students' particular needs at the time of the tutoring session, instead of heavily relying on a pre-planned agenda. However, if tutors have a curriculum script at their disposal entailing both goals and example exercises to reach these goals, it is possible that such a curriculum script might function as a barrier to providing adaptive support (Chi et al., 2008; Graesser et al., 2009; Graesser et al., 1995; VanLehn, 2011). Similarly, in line with Roscoe (2014) and the epistemological hypothesis, it can be argued that providing tutors with a curriculum script might increase the feasibility that tutors perceive their role as one of sharing or delivering the information presented in the script. It possible that they considered the script as an absolute or authoritative source, resulting in a strong dedication to the material. As such, these findings stress the difficulty to find the right balance between structure and autonomy and suggest a need for more research regarding the *amount or type of structuring*. In this respect, future studies should further investigate the impact of well-structured curriculum scripts on both tutoring processes and learning gains by comparing different conditions: a well-structured curriculum, a less-structured curriculum (e.g., only detailing the core topics and learning goals), or no curriculum script. Regarding the latter, researchers should, however, be aware of the higher demands posed to the tutors, as they not only have to focus on their tutoring skills but also have to engage in the selection of content topics of SRL and on a more intensive content-related preparation of the session.

Additionally, future research could specifically investigate the added value of the curriculum script as such, for example, by comparing experimental conditions in which the curriculum script is implemented by classroom teachers in daily classroom practice versus implementation of the curriculum script by tutors in a student tutoring setting.

Related to the previous topic, the second suggestion for future research concerns the specific *content* targeted in the *curriculum script* and more specifically, the choice to opt for a combination of different types of SRL strategies versus a selection of SRL strategies. In line with the theoretical trend of recent models of SRL which advocate the consideration of not only cognitive and metacognitive, but also of motivational factors, different studies have shown that adopting a multidimensional approach in fostering SRL is more effective that training selected components (Dignath et al., 2008; Leopold, den Elzen-Rump, & Leutner, 2007; Leopold & Leutner, 2015; Perels, Gürtler, & Schmitz, 2005; Schraw, Crippen, & Hartley, 2006; Schunk & Ertmer, 2000). However, it is also possible that such an approach might be too demanding or overwhelming for younger students and/or struggling learners (Donker, de Boer, Kostons, van Ewijk, & van der Werf, 2014; Hattie et al., 1996; Whitebread & Pino Pasternak, 2010). Future research could explore the differential effects of an intervention targeting all three main components, such as in the current intervention, compared to interventions restricted to a more limited subset of strategies. Furthermore, it could also be investigated whether prolonging the intervention might be helpful to diminish the cognitive load a multidimensional approach may cause.

A third suggestion refers to the *contact arrangement* of student tutoring programmes. In the current student tutoring programme, tutoring occurred in a small group setting which is less common than one-to-one tutoring (Gordon et al., 2007; Ritter et al., 2009). The effectiveness of one-to-one tutoring compared to large group instruction has been repeatedly confirmed across different ages and contexts (Cohen et al., 1982; Graesser et al., 2009; Slavin, Lake, Davis, & Madden, 2011). To date, few researcher or educators would doubt that one-to-one tutoring is effective. In contrast, results regarding the comparison of one-to-one tutoring to small group instruction has revealed mixed results. For example, Vaughn et al. (2003) found that the effects of small groups consisting of no more than three students were comparable to direct one-to-one instruction. Similarly, Elbaum, Vaughn, Hughes, and Moody (2000) and Gersten et al. (2009) stated that small-group tutorials might be as effective as one-to-one tutoring. However, based on their review Slavin et al. (2011) concluded that small-group tutorials can be effective, but are not as effective as one-to-one tutoring. Moreover, these studies focused on reading as curriculum of tutoring. Consequently, future research might invest in comparing the effectiveness of one-to-one tutoring with small group tutorials, specifically regarding students' SRL. While one-to-one tutoring might increase the chance of more individualised and adaptive support, in small-group settings the interaction between the tutees might provide additional learning opportunities. Also in the light of socially shared SRL, small group settings might be beneficial.

A fourth suggestion concerns the *training of the tutors*. Although it is conceivable that training tutors can enhance deep learning (Graesser et al., 2011), based on the available research there is still ambiguity whether extensively training tutors significantly improves learning over and above the normal strategies of unskilled or minimally trained tutors (Graesser et al., 2009). Given the complexity of fostering SRL, we believe, however, that training of tutors is advisable as even experienced tutors and teachers struggle to implement sophisticated pedagogical strategies and high-SRL environments (Cade, Copeland, Person, & D'Mello, 2008; Graesser et al., 2009; Perry, Hutchinson, & Thauberger, 2007; van de Pol, Volman, & Beishuizen, 2012). However, future research comparing the current student tutoring programme with a programme without prior training and more intensive ongoing support for tutors is needed to confirm this assumption. Taking into account the results in chapter 6, additional training and support appears necessary to increase the tutoring quality. Also regarding this issue, future research is needed to investigate whether these additional efforts result in significantly higher effects of student tutoring. For example, the impact of the current prior training can be compared to a more intensive training by supplementing the current training with hands-on practice opportunities regarding questioning and feedback. However, it is possible that such a training would be rather overwhelming for inexperienced tutors. In this respect, future research could also incorporate a third condition in which the training is split into two parts. More concretely, prior to the sessions tutors could receive training regarding general tutoring skills. After a few sessions, for example in the middle of the intervention and when tutors have had the opportunity to practice and become more familiar with the basic principles of tutoring, tutors can receive the training targeting the promotion of SRL.

Finally, a last suggestion regarding the student tutoring programme design stems from the consideration that students' academic pathways are influenced by multiple sources, such as student characteristics (e.g., IQ, language), family characteristics (e.g., quality of family learning environment, aspect of parenting), sociocultural factors (e.g., parents' education and ethnicity), and schooling factors (e.g., teacher-student relationship, peers). From this perspective, it might be necessary that intervention efforts for children at risk for academic problems not only focus on strengthening children's personal characteristics, such as in the current student tutoring programme, but also involve the *broader family and sociocultural context* (Gutman, Sameroff, & Cole, 2003; McClelland, Acock, & Morrison, 2006; Rimm-Kaufman & Pianta, 2000; Ross, 2009). One possible approach to take the broader family context into account, is by focusing on the parent-child interaction. In this respect, studies have shown that a number of socio-emotional (e.g., presence of positive affect, parental responsiveness) and instructional parental behaviours (e.g., use of metacognitive talk, contingent instructional scaffolding) can have an impact on children's development as motivated and self-regulated learners (Grolnick, Kurowski, & Gurland, 1999; Pino-Pasternak, Whitebread, & Tolmie, 2010; Robinson, Burns, & Davis, 2009; Turner & Johnson, 2003). Research also shows that parent–child social interactions vary in families from different culturally and socio-economically diverse backgrounds (Harris, Robinson, Chang, & Burns, 2007; Howse, Lange, Farran, & Boyles, 2003; Pino-Pasternak et al., 2010). For example, prior studies on the role of parenting in low-income families have found less responsive and consistent parenting and opportunities to practice self-regulating behaviours were less apparent (Eisenberg et al., 2001; Evans & Rosenbaum, 2008). In this respect, Gordon et al. (2007) suggest that tutoring students at home can facilitate the coaching of parents and it has been shown to be beneficial to enhance parents' involvement and to empower parents in establishing a supportive learning environment at home. Future research could expand the current student tutoring programme by supplementing the sessions during school hours with sessions at home, with the aim to not only provide assignment-assistance tutoring during homework (Hock et al., 2001), but also to coach parents in how they can support their children's behavioural and cognitive learning attitudes and processes (Gordon et al., 2007).

Investigating the effects for tutors and teachers

As within the research field of student tutoring mainly gains for tutees are targeted (Ritter et al., 2009; Topping & Hill, 1995), the present dissertation focused only on studying the effects for the tutees. However, within the current student tutoring programme two other actors are involved, namely the tutors and the classroom teacher. To more fully map out the effects of the current student tutoring programme, future research might also include outcome variables for both tutors and classroom teachers.

In accordance with the objectives of the current student tutoring programme for the tutors, future research should investigate whether their tutoring skills and their understanding and sensitivity towards linguistically, ethnically, and culturally diverse students has improved. More concretely, in a pre-posttest design students' tutoring skills could be observed at the beginning and at the end of the intervention by means of a scoring rubric entailing the key tutoring processes (e.g., questioning, feedback, nurturing learning environment, balance between autonomy support and structure). In line with Cho and DeCastro-Ambrosetti (2005) a survey consisting of demographic questions (e.g., experiences and exposure to cultural and linguistic diversity) and items regarding multicultural curricular issues, cultural pluralism and social structural equality could be administered. In addition, outcomes regarding the curriculum content at hand, namely SRL, could be taken into account as well. First, tutors' beliefs regarding SRL can be assessed by means of Self-Regulated Learning Teacher Belief Scale (SRLTB) (Lombaerts, De Backer, Engels, van Braak, & Athanasou, 2009). Second, in line with Dignath-van Ewijk and van der Werf (2012) tutors' knowledge regarding SRL instruction could be assessed by a self-report measure entailing both close-ended items and open-ended questions. Third, tutors' SRL behaviour might be measured by means of think aloud protocols. The proposed outcome variables for tutors can also be assessed in the longer term to investigate the long-term impact on their functioning in future work environments (e.g., teacher training, teaching practice).

Furthermore, given the possible outcomes for tutors (i.e., increased understanding and sensitivity towards students from diverse backgrounds and increased beliefs, knowledge and skills to support SRL), it might be interesting in future research to engage pre-service teachers as tutors. This suggestion is based on two considerations in the literature. First, while the number of school-aged students from diverse backgrounds is increasing, research indicates that the majority of pre-service teachers continue to be predominantly middle class and native speakers. Studies have shown that many pre-service teachers have a lack of knowledge of the experiences, needs, and resources of culturally and linguistically diverse student populations (Cho & DeCastro-Ambrosetti, 2005). Consequently, teacher training programmes are charged with the task of preparing pre-service teachers for classrooms with increased diversity regarding both student background and capabilities (Cho & DeCastro-Ambrosetti, 2005; Sleeter, 2001). Second, research findings suggest that SRL is difficult to attain by pre-service teachers (Kramarski & Michalsky, 2010; Perry et al., 2007; Randi, 2004), underlying that teacher training programmes should strive to increase pre-service teachers' SRL throughout the training period as well as preparing them to facilitate SRL among their future pupils (Kramarski & Michalsky, 2009; Michalsky & Schechter, 2013; Tillema & Kremer-Hayon, 2002; Vrieling, Bastiaens, & Stijnen, 2012). To meet these requirements, incorporating a student tutoring programme focusing on at-risk students' SRL in teacher training programmes may be an added value and could provide input for future research.

Regarding studying possible *outcomes for teachers* involved in current tutoring programme, the following suggestions can be made. First, as teachers beliefs (and more specifically their SRL beliefs) are considered as an important prerequisite for implementing SRL practices (Dignath-van Ewijk & van der Werf, 2012; Lombaerts, De Backer, et al., 2009; Perry & Rahim, 2011), it might be interesting to investigate if teachers' cooperation in the student tutoring programme influenced their SRL beliefs. Furthermore, it could be assessed if they adjusted their SRL practices accordingly. Teachers' SRL beliefs could be assessed by a self-report questionnaire (e.g., Self-Regulated Learning Teacher Belief Scale (SRLTB); Lombaerts et al., 2009). In assessing teachers' implementation of SRL practices, a multi-perspective approach could be adopted by combining self-report measures (e.g., Self-Regulated Learning Inventory for Teachers (SRLIT); Lombaerts, et al. 2007), classroom observations (e.g., Assessing how Teachers Enhance Self-regulated learning (ATES); Dignath-van Ewijk, Dickhäuser, & Buettner, 2013) and students' ratings of the learning environment (e.g., Teacher as Social Context Questionnaire (TASC); Belmont, Skinner, Wellborn, & Connell, 1988).

Alternative analysis technique to investigate tutoring interactions

In order to illustrate the interaction between tutor and tutees, in chapter 6 it was explored which action preceded or followed particular tutor moves. To more clearly and comprehensively map out these interactions, *social network analysis* applied to the tutoring processes could be a valuable and innovative way (Daly, 2010). Social network research is based on the assumptions that actors in a social network are interdependent rather than independent and that the relationships are regarded as conduits for the exchange or flow of resources such as information, knowledge, and materials. Further, patterns of relationships, captured by social networks, may act as 'constraints' and/or offer opportunities for individual action (Daly, 2010; Moolenaar, 2012). Social network analysis uses explicit mathematical models, which help induce the highest degree of objectivity possible and provide graphical imagery of human relationships.

Based on social network analysis a network is generated consisting of a set of nodes or actors (e.g., persons, teams, departments) with a set of dyadic ties of a given type (or multiple types; e.g., friendship, communication patters, interactions) connecting the nodes (Carolan, 2013; Daly, 2010). In recent years, social network analysis is increasingly and successfully adopted in the educational research field. The application of social network research within educational studies, however, has mainly focused on the examination of teachers' collaboration across and within schools or districts (Moolenaar, 2012). Given the relevance of the social context in tutoring and SRL, we believe that social network analysis will be an interesting perspective and analysis technique.

Exploring other approaches to promote SRL

In the current dissertation, we focused on a specific format of tutoring, namely student tutoring. Future research could also take a broader scope. First, further research could explore the potential of reciprocal peer tutoring and cross-age peer tutoring to stimulate late primary school children's SRL. Whereas peer tutoring has mainly focused on subject-specific curricula as well, studies focusing on higher order skills have found promising effects. For example, De Backer et al. (2012) found that reciprocal peer tutoring appears to be a promising instructional approach for fostering university students' metacognitive regulation. Taking this into account, it might be worthwhile to explore this in a younger age group too. Given the younger age of our target group, careful attention should be paid to tutor training and support as well as to the role of the classroom teacher in providing intensive and close guidance to the tutoring groups (King, 1997; Van Keer & Verhaeghe, 2005).

Second, although a multitude of studies report on the effects of SRL on academic achievement and on intervention effects of training SRL, there is comparatively only a small body of research focusing on the *instruction of SRL by regular classroom teachers*. Moreover, these studies mainly rely on self-report measures and less on classroom observations (Dignath-van Ewijk et al., 2013; Kistner et al., 2010). Nevertheless, available studies show that teachers devote little attention to SRL and especially explicit SRL instruction is limited. Besides a further investigation of the specific actions that teachers undertake to support SRL (e.g., by means of classroom observations) and of the factors influencing teachers' integration of SRL practices, future research should focus on how learning environments aimed at improving students' SRL can successfully and sustainably be implemented by classroom teachers (Dignath & Büttner, 2008; Perry et al., 2007; Randi & Corno, 2000). In this respect, it is advisable to set up close partnerships between researchers and teachers (Abrami, Poulsen, & Chambers, 2004; De Corte, Verschaffel, & Op' t Eynde, 2000; Perry et al., 2007; Perry, Phillips, & Hutchinson, 2006; Randi & Corno, 2000; Spruce & Bol, 2014). Randi and Corno (2000) argue that such partnerships can take the format of a collaborative innovation, which they describe as "a process whereby teachers and researchers work together to meld theory and practice through the construction, assessment, and documentation of new, teacher-generated curricular and instructional practices consistent with contemporary learning theory, yet carefully attuned to individual differences of both teachers and students involved (p. 660).” As such, researchers collaborate with teachers (1) in the development of the SRL innovations to suit their unique teaching and learning contexts, (2) to provide ongoing support and coaching to the teachers and (3) to document the results. Obviously, training and support regarding SRL should not be restricted to in-service teachers, but also pre-service teachers should be intensively engaged in learning environments that reflect the self-regulated learning approach and provided with the necessary knowledge and skills to support students' SRL. In this respect, and based on the concept of collaborative innovation, Perry and colleagues (e.g., Perry et al. 2007; Perry et al., 2006) have developed a framework to mentor pre-service teachers in designing and developing practices that foster SRL in primary school students. In this framework, teachers are brought together monthly as communities of skilled professionals in which they (1) set goals for themselves and their students, (2) design and implement activities to address their goals, and (3) monitor and evaluate their progress toward their goals. They proceed through these phases with guided and sustained support from teacher and researcher colleagues. Moreover, these meetings provide them with a context for learning similar to the one proposed for their students.

Implications of the dissertation

The studies in this dissertation build on theoretical and empirical insights from two main research areas, namely self-regulated learning (e.g., Boekaerts, Pintrich, & Zeidner, 2000; Pintrich, 2004; Zimmerman & Schunk, 2011) and tutoring (e.g., Chi et al., 2001; Graesser et al., 2011; Topping & Ehly, 2001). Consequently, this dissertation contributes to these theories and their related empirical base. Implications for theory, research, practice and policy regarding both theories and research fields are formulated.

Implications for theory and empirical research

First, this dissertation extends the increasing research interest on the measurement of SRL by the development of two new instruments to assess late primary school children’s SRL, whereas previous SRL instruments mainly centre on secondary or higher education students. More concretely, a self-report questionnaire (CP-SRLI) and think-aloud protocol (TAP) coding instrument were developed. These instruments are grounded in the theoretical framework of Pintrich (2000) and largely confirm the hypothesised SRL strategies categorisations. First, as the CP-SRLI can be easily administered in groups it can stimulate large-scale investigation of late primary school children’s SRL, which is currently only of limited availability (Cooper & Corpus, 2009; Wigfield & Eccles, 2000; Winne & Perry, 2000). Second, as the CP-SRLI comprises multiple scales reflecting the three main components of SRL, it provides researchers with the opportunity to investigate the multiple components of SRL simultaneously by using a single instrument, instead of relying on different instruments. As such, the CP-SRLI provides a coherent set of measures minimising measurement difficulties when used in conjunction in research. Moreover, the inclusion of several components allows researchers to obtain a differentiated view of students' perceptions of their engagement in SRL. The comprehensiveness of the CP-SRLI can also create opportunities to explore the interrelationships among the self-regulatory components on the one hand and the relationships between the components and significant student characteristics on the other hand, leading to further theory development. On the other hand, as separate factor analyses on the predefined theoretical components were used, researchers can also opt for selecting a distinct set of CP-SRLI scales consistent with the particular focus of their research. Furthermore, by following simple guidelines (see for example Samuelstuen & Braten, 2007), the CP-SRLI can easily be adapted to other contexts than academic homework contexts or more specific tasks. This opens possibilities for assessing SRL in a more task-specific manner and to align the self-report data with data obtained by means of on-line measures during the same task (McCardle & Hadwin, 2015; Merchie & Van Keer, 2014b).

This brings us to the need to triangulate different methods in assessing SRL (Boekaerts & Corno, 2005; Schraw, 2000; Veenman, 2005). Although we believe that self-report data are valuable to provide insights into learners' perceptions of their own actions, which subsequently serve as the basis for choices regarding SRL use in future learning tasks (McCardle & Hadwin, 2015), we also acknowledge the drawbacks of self-report data. Therefore, we advise to supplement the self-report data obtained through the CP-SRLI with on-line methods. In this dissertation we opted for the use of TAP. While TAP has been increasingly used during the last decade as a method to obtain detailed information on students' actual SRL use (Bannert & Mengelkamp, 2008; Greene et al., 2011), the method is rarely used in research focusing on primary school children. In this respect, the current studies illustrate that – under the condition that participants receive a short training – TAP is also applicable to assess late primary school children's SRL. This dissertation also confirms the value of data triangulation in assessing SRL. For example, motivational aspects were difficult to capture by means of TAP, but based on the CP-SRLI data information regarding students' motivation and the use of motivational strategies was obtained. Similarly, students' own perceptions could be compared to their actual use of SRL. This comparison might be a valuable starting point in setting up interventions and personal guidance (see further). Hence, both instruments can be considered as valuable additions to researchers' methodological toolkits to perform research on SRL among late primary school children.

Besides the measurement of SRL, this dissertation also extends current literature on SRL on different levels. First, in response to the dominant focus of prior studies on older students, this dissertation focused on late primary school children's SRL. Second, a specific group of students was targeted, namely students from low socio-economic and/or immigrant backgrounds. Findings obtained through the different studies confirm that these students are able to perform SRL (Perry et al., 2010; Whitebread et al., 2009; Whitebread & Pino Pasternak, 2010), but do so on a rather basic and limited level. Moreover, longitudinal data showed that – without targeted training - students' self-regulatory strategy use remains rather stable over time. This confirms that in many cases SRL does not develop spontaneously (Askell-Williams et al., 2012; Boekaerts, 1997; Dembo & Eaton, 2000; Schneider, 2008; Schunk, 2001; Schunk & Ertmer, 2000; Weinstein et al., 2000) and that additional efforts in promoting SRL among fifth and sixth graders with low socio-economic and/or immigrant backgrounds is warranted. In this respect, this dissertation explored the effects of student tutoring on SRL, an approach that has not been studied in prior studies. The findings indicate that this method is particularly beneficial to empower low-motivated learners regarding motivational aspects, but for the majority of the students no clear evidence of a strong positive impact was found. Although quite high quality tutoring was observed, the findings indicate that the expectation that a relatively brief, small-group student tutoring intervention can have the power to empower students with low socio-economic and/or immigrant backgrounds regarding a complex and multi-faceted skill, such as SRL, might be too high.

Also within the research field of student tutoring, the focus on SRL is innovative as prior studies have mainly focused on subject-specific content. Notwithstanding the fact that student tutoring is widely applied in practice, the empirical base remains curiously thin. By focusing on student tutoring we took a first step to extend the research interest in student tutoring.

Third, in line with the request to not only investigate the impact of interventions, but also to examine how these work (Pressley et al., 2006), we also investigated the underlying student tutoring processes. Besides illuminating the current results regarding the effectiveness of student tutoring and unravelling student tutoring processes focusing on SRL, the findings of the process study are also informative for the design and development of pedagogical agents in computer-based learning environments, which is a fast growing research topic within SRL (Azevedo & Hadwin, 2005; Graesser & McNamara, 2010; Hadwin, Wozney, & Pontin, 2005).

Finally, this dissertation can be considered as an important starting point encouraging future research to deepen our understanding regarding the development of SRL among at-risk students, how it can be promoted effectively, as well as how variations in the design of student tutoring programmes can increase the effectiveness of this method. In this regard, various suggestions for future research were postulated above, which can inspire researchers in the field of SRL as well as in the field of tutoring.

Implications for practice

The findings of this dissertation demonstrated students' limited and rather superficial application of SRL as well as the complexity of stimulating SRL among late primary school children. These results strongly suggested a need for additional training of SRL. Although some benefits of student tutoring were observed, it seems equally important to mobilise teachers to increase their efforts in integrating SRL practices during daily classroom practice. Given the finding that spontaneous development of SRL is scarce and given the minimal effects of rather intensive tutoring sessions specifically targeting students' SRL, this dissertation stresses the need for continuous support throughout primary education and intensively immersing students in learning environments that embody the self-regulated learning approach. This goal of permanent, structured, and consistent attention to SRL throughout primary education and embedment in the class curriculum cannot be achieved from the solitary actions of individual teachers, but has to be a shared goal among teachers within a school team.

To support such school-based implementation of SRL practices, the '*teacher enquiry and knowledge-building cycle to promote important outcomes for students'* described by Muijs et al. (2014) might be a helpful framework to guide such school-based implementation of SRL practices for school teams and leaders (see Figure 2). In following paragraphs, we will use the 'teacher enquiry and knowledge-building cycle' as framework to describe and illustrate how the findings of this dissertation can inform or be helpful for the educational practice.

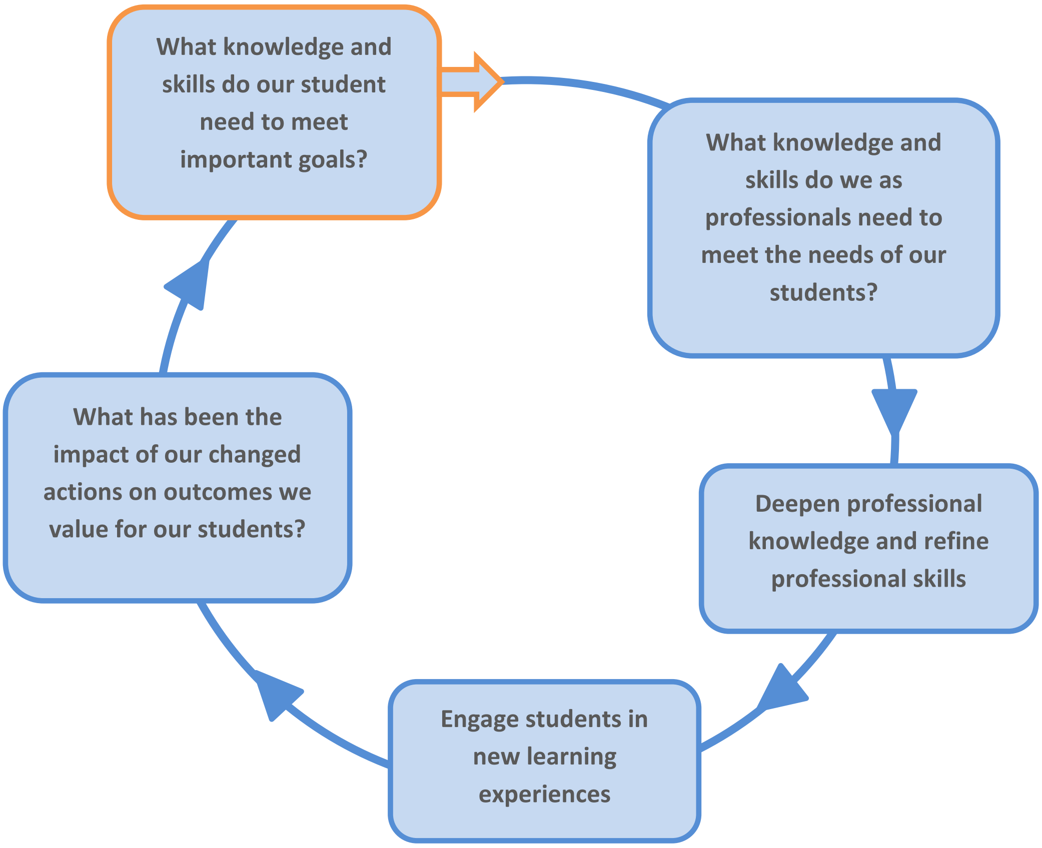

Figure 2. Teacher enquiry and knowledge-building cycle to promote important outcomes for students (Muijs et al., 2014, p. 247).

As a first step, teachers are encouraged to analyse the discrepancy between students' current knowledge and skills and the targeted goals at hand, in this case SRL. Part of this process is selecting and collecting relevant evidence of students' current knowledge and skills. Regarding this matter, the instruments developed in the light of this dissertation can be helpful. As the CP-SRLI can be easily administered and scored in groups, this questionnaire can provide teachers with a differentiated portrait of students' perceptions of their engagement in SRL. These perceptions can be confronted with information about students' actual use of SRL. Teachers can obtain this information by using the developed TAP method and coding scheme. Given the time- and labour-intensive nature of this method, this might be less practical in classroom context.

However, teachers can supplement the CP-SRLI data with observations or traces obtained when students engage in independent tasks or collaborative learning during classroom practice. This first step is an important starting point, as it is argued that if teachers are provided with specific information about their students' SRL, this might enhance their understanding about the significance of SRL and elicit teachers' engagement to integrate effective SRL-practices supporting students in developing SRL (Askell-Williams et al., 2012; Butler, Cartier, Schnellert, Gagnon, & Giammarino, 2011; Whitebread et al., 2009). Further, we believe that sharing this comparison between self-report data and students' actual use of SRL with the students can be a powerful learning experience for students. As aforementioned, students monitor their learning in relation to these personal perceptions of their learning approach and its outcomes (Winne & Jamieson-Noel, 2002). As such, misinterpretations of SRL (i.e., overestimation) can result in persistent use of inadequate strategies, as students will not experience the need for the development and use of more productive forms of SRL (Winne, 2004). Therefore, confronting students' perceptions and beliefs about their self-regulated learning practices with their actual self-regulated learning behaviour is not only valuable for the teacher in the light of setting up appropriate training, but also for the students (Credé & Phillips, 2011; Pajares & Valiante, 2002; Perry & Rahim, 2011; Turner & Patrick, 2008). In this first phase, these instruments mainly serve diagnostic goals, but the instruments can also be useful in light of summative and formative assessment during training of SRL (Schraw & Impara, 2000; van Hout-Wolters, 2009).

In a second step, teachers identify for themselves which knowledge and skills they already have at their disposal, and on which areas they require additional information, knowledge, and skills. Although this dissertation does not report findings regarding these matters, previous studies have shown that both pre-service and in-service teachers often lack sufficient knowledge and competence of SRL (Endedijk, Brekelmans, Verloop, Sleegers, & Vermunt, 2014; Veenman et al., 2006; Wilson & Bai, 2010). Moreover, teachers also feel unsure about how to improve and stimulate SRL among their students (Perry et al., 2007; Spruce & Bol, 2014). Therefore, in this stage, it will also be important to expose teachers' educational beliefs and personal beliefs about the importance of SRL and how these goals can be achieved, as these beliefs have been found to influence their willingness to adapt SRL practices (Dignath-van Ewijk & van der Werf, 2012; Moos & Ringdal, 2012; Perry & Rahim, 2011; Waeytens, Lens, & Vandenberghe, 2002; Woolfolk Hoy, Davis, & Pape, 2006). For example, Spruce and Bol (2014) found that primary and middle school teachers in general have positive beliefs about the role of SRL, but have some reservations about their students' ability to self-regulate. Similarly, Hornstra, Mansfield, Van der Veen, Peetsma, and Volman (in press) found that teachers in disadvantaged schools report frequent use of controlling practices, mainly due to their beliefs that at-risk students lack the necessary skills and therefore benefit more from controlling behaviour. Consequently, an examination – and if necessary – modification of deeply ingrained assumptions and beliefs is an important step towards the implementation of SRL (Waeytens et al., 2002). Based on this step and identified needs of teachers, initiatives can be undertaken to deepen teachers' knowledge and refining their skills.

In a following step, teachers can integrate and experiment with new instructional practices, or more specifically SRL practices. In this respect, the curriculum script designed in the light of the student tutoring programme in the present dissertation can provide primary school teachers with concrete input and learning materials to address key SRL strategies. Besides a booklet containing learning material for students and a manual, also several learning aids (e.g., format to make a week planning, a chart displaying the general self-regulated learning cycle, learning strategy cards) were developed to support students in applying SRL. For example, in the curriculum script a general self-regulated learning cycle is used to make students attentive to the key SRL processes when executing a task. This learning cycle can easily be adopted across subjects and provides teachers and students with a clear framework to address SRL. Further, based on the findings several points of interest can be drawn. First, as mentioned above, confronting students' perceptions of SRL use with their actual use might be important to make students receptive for the upcoming training efforts (see chapter 5). Second, given the observed individual variability in SRL (see chapter 4 and 5), instruction should take students' individual differences into account. Third, besides providing explicit instruction to increase students' strategy knowledge, students should be offered sufficient opportunities to observe SRL strategies (i.e., teacher modelling SRL) as well as opportunities to practice SRL accompanied with constructive feedback (see chapter 6). Fourth, in providing these practice opportunities it is important to ensure that this is done across different subject areas and tasks and strongly connected to the class curriculum (see chapter 4 and 5). Fifth, the current results illustrated that students encounter difficulties in simultaneously implementing metacognitive, motivational, and cognitive strategies, and addressing SRL process across the different SRL phases (see chapter 4 and 5). As such, teachers should be attentive that they address all three key components of SRL. Furthermore, teachers should also encourage students' integrated use of self-regulatory strategies and should stress the interrelations between several SRL (sub-)processes. For example, students in the current studies found it difficult to purposefully monitor their learning processes by more adequately using the information gathered during task orientation, to react properly on monitoring activities, and to use different cognitive learning strategies in an integrated instead of rather isolated manner.

In a final step, the impact of the teachers' actions could be documented. As mentioned, the instruments developed in the current studies can be used for this goal. Further, the findings of this dissertation illustrated that movement towards SRL is a complex and longitudinal process, so teachers should focus on the effects in the long-term rather than expecting immediate effects. In addition, the current findings suggest that it might be equally important to focus on the quality of strategies than solely on the frequency of occurrence of the strategies in judging students' improvement regarding SRL.

Further, regarding the practice of student tutoring, we previously stated that further research is needed to identify the crucial preconditions of effective student tutoring programmes. As the research field of student tutoring is currently underexposed and in addition to the minimal effects found in this dissertation, educational practitioners should communicate realistic expectations regarding student tutoring programmes. This is needed in order to prevent disappointment, which in turn might hamper further dissemination, replication, and embedding of student tutoring initiatives. Based on the findings in this dissertation, we asserted that increasing and broadening tutors' training and ongoing support might be a promising approach to increase the likelihood of attaining positive effects. However, in a time of restricted resources, carefully balancing the costs of additional training and support with the potential benefits might be appropriate. As student tutoring programmes are rather short-term with frequently changing tutor populations, one could argue that it would be more cost-effective to re-orientate the training and support efforts towards classroom teachers instead of tutors.

However, in our view, both perspectives do not have to be mutually exclusive. In line with the finding that multifaceted approaches are more beneficial to empower students at-risk for school failure (e.g., Ross, 2009), and especially given the complexity of SRL, we believe that the alignment between student tutoring initiatives and classroom practice can be fruitful (Gordon et al., 2007; Wasik, 1998). As such, tutors can be complementary to daily classroom practice in providing more individualised help and teachers can build on this additional support to increase and sustain the effects of student tutoring programmes. In this respect, the response-to-intervention approach might be suitable. In a response-to-intervention model, a multi-tiered intervention is provided. The nature of the intervention changes at each tier, becoming more intensive as a student moves across the tiers. Generally, three levels of support are distinguished: whole-class instruction, small group instruction, and one-on-one coaching (Fuchs & Fuchs, 2006). In first instance, all children receive evidence-based high-quality classroom instruction (i.e., whole-class instruction). This tier is followed by small group instruction for students who did not respond to the intervention and this in addition to tier 1 instruction. For students who continue to struggle after tier 2, instruction is provided with a tier 3 intervention consisting of more intensive and individualised support from educational experts or specialised services (Fuchs & Vaughn, 2012). Within this concept, student tutoring can potentially be an adequate method to provide additional and more intensive guidance to students who did not respond to classroom instruction regarding SRL in tier 1 instruction. Following this approach, training and support efforts can also simultaneously be directed to teachers and tutors.

Implications for policy

By the stipulation of cross-curricular 'learning to learn' attainment targets for primary education, the Flemish educational government provides a strong signal to the educational field that SRL is viewed as an important educational goal within the Flemish educational system. The underlying assumptions and principles of the cross-curricular attainment targets are generally also in line with the contemporary SRL research literature. First, the attainment targets not only reflect metacognitive and cognitive aspects of SRL, but also motivational aspects. Second, SRL is not only valued because it can lead to success in and beyond school, but also as an objective as its own. Third, as the attainment targets are formulated as cross-curricular targets, schools and teachers are encouraged to adopt instructional methods across subjects and courses to encourage students to plan and organise their own learning, to identify, select, and effectively apply learning strategies, to reflect on their performance and learning processes, and to nurture positive learning attitudes (Departement van Onderwijs en Vorming, 2008). In this respect, the cross-curricular targets 'learning to learn' provide an adequate basis for educational practice. Unfortunately, however, the findings of this dissertation show that the majority of the Flemish at-risk late primary learners encounter difficulties in regulating their learning in an efficient and effective way. Moreover, research shows that teachers rarely or insufficiently integrate SRL practices in their daily classroom practice (e.g., Lombaerts et al., 2007; Kistner et al., 2010). Therefore, educational policy makers should encourage SRL training in teacher training programmes as well as continuous and qualitative professional development of in-service teachers to raise teachers' competence to integrate SRL practices and to support children in their development of SRL. This also implies that educational counselling services for schools need to be trained accordingly in order to be able to coach and support teachers in their task to foster SRL among their students. In order to reach a sustainable implementation of SRL, teachers' support and training should be accompanied with the designing and adopting of novel curricula, educational materials and assessment instruments in line with the premises of SRL learning environments. But this additional training and support of teachers also implies a call for further research regarding SRL. In this respect, contemporary SRL research has paid relatively little attention to questions regarding (1) the level of experience and expertise required to create high-SRL environments, (b) how teachers acquire such expertise, and (c) how classroom instruction needs to be to influence students' SRL positively (e.g., De Corte, 2000; Dignath et al., 2008; Perry et al., 2007). So, in order to improve the attainment of the cross-curricular targets and the accompanied need for professional development of both in-service and pre-service teachers, educational policy should encourage this kind of research.

By promulgating a decree regarding subsidising student tutoring initiatives, student tutoring has received a more formalised place within the Flemish educational field. However, as articulated in this dissertation, future research is needed to gain more insight into the crucial preconditions and characteristics of successful student tutoring programmes. Educational policy could encourage such research to stimulate gaining more in-depth insight into evidence-based practices regarding student tutoring. Further, a stronger evidence base on student tutoring programmes would also inform educational policy on the allocation of resources to particular designs of student tutoring programmes and investing in evidence-based professional development of tutors.

Final conclusion

The demands of the twenty-first century expect students to know more than content knowledge; they are required to know how to learn as well. SRL is in this respect considered as an important basis for the development of effective life-long learning skills. It is expected that students will develop the ability to actively engage during learning, for example by means of setting appropriate goals, maintaining motivation, selecting effective learning strategies, accurately monitoring learning, and adjusting the use of strategies. Both in research and educational practice, it is believed that these are critical competencies that should be a central and explicit aim in education. Unfortunately, however, not all learners are effectively self-regulating their learning and teachers struggle to integrate SRL in an explicit and effective way in their daily classroom practice. As such, this dissertation aimed to gain more insight into late primary school children's SRL and to explore whether student tutoring is a fruitful way to foster students' SRL.

The research goals of this dissertation are situated at the intersection of two research fields, namely the research field of SRL and student tutoring. First, stemming from the paucity of measures to assess late primary school children's SRL, a self-report questionnaire and think-aloud protocol was developed. Based on these instruments' SRL among late primary school children was documented. Moreover, we specifically focused on students from low socio-economic background and/or immigrant backgrounds, as research on SRL among this target group is limited despite the indications that these students are likely to encounter more difficulties with SRL. The results show that at-risk late primary school students are able to apply SRL, but active and deep-level engagement in learning tasks was rarely observed. Moreover, students' strategy use remained rather stable over time, characterised as basic and superficial. The comparison of the self-report data with the think-aloud data also illustrated students' tendency to overestimate their self-regulated learning strategy use. These findings underline the need for additional training.

In this respect, the effects of student tutoring were explored as an innovative method to stimulate SRL. The focus on SRL as curriculum of tutoring was also new within the research field of student tutoring. The studies performed in the light of this research goal showed that strategy acquisition among at-risk late primary school children is more complex and variable than orginially assumed. Although some benefits were found, especially on motivational aspects of SRL and for low motivated learners, student tutoring as a method for improving SRL among at-risk students did not fully meet the expecatations. Some possible explanations for these unexpected results were investigated by studying the interactions between tutors and tutees. This study further showed that with adequate training and support inexperienced tutors provide rather high quality tutoring, specifically characterised by interactive tutoring. However, given the complexity of fostering SRL, it appears that this interactive tutoring should be supplemented with more targeted instructional principles regarding the promotion of SRL, which were applied in a rather limited way in the studied tutoring sessions.

Regarding the promotion of SRL, we believe that there will be no one panacea to stimulate complex and multi-faceted skills such as SRL among socio-economically disadvantaged and immigrant students. Instead, high-quality and continuous support combining different kinds of intervention tailored to the specific needs and profiles of the students will be needed to obtain lasting effects. In this respect, this dissertation provides a spectrum of possible avenues for future research. We hope that this dissertation will pave the way for more research into at-risk students' SRL and into the potential of student tutoring to foster a complex but imperative educational goal such as SRL.

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Appendix

Main results, limitations and suggestions for future research, and implications of the studies linked to the research goals and dissertation chapters

<table>
<tr><th>Chapter</th><th>Main results</th><th>Limitations and suggestions for future research</th><th>Implications</th></tr>
<tr><td colspan="4">Research subgoal 1: Development of instruments</td></tr>
<tr><td>3</td><td>- The ‘Children’s Perceived use of Self-Regulated Learning Inventory (CP-SRLI) is reliable measurement instrument to comprehensively gain insight into the different components of late primary school children’s SRL. The final version entails following subscales: task orientation, planning, external regulation, introjected regulation, identified regulation, intrinsic motivation, self-efficacy regulation, self-efficacy motivation, deep-level learning strategies, surface-level learning strategies, motivational strategies, monitoring, persistence, product evaluation, process evaluation.
- Measurement invariance across gender was found
- The internal consistency of the (sub)scales were acceptable to good.
- The different (sub)scales significantly correlated with each other, except for ‘external regulation’ which was not significantly correlated with the majority of the other subscales.</td><td>- While recognizing the drawbacks of self-report inventories, also the value of these measures to gain insight into students’ own perceptions is postulated. Triangulating these data sources with data of on-line methods is advised to obtain a broader and more in-depth view on students’ SRL.
- As no achievement outcomes or other measures of SRL were incorporated in the study, further research should be conducted to investigate predictive and convergent validity of the CP-SRLI.
- As the CP-SRLI was initially validated among a specific group of student, namely Flemish fifth and sixth graders, validation among other age groups (i.e., secondary school students) and students from different cultural contexts is wanted.</td><td>- The developed CP-SRLI can be used as a coherent set of measures reflecting the multi-component nature of SRL. This measure can be helpful to (1) extend researchers’ methodological toolkit mapping out students’ perceptions of their SRL use complementary to on-line measures, (2) stimulate large-scale investigations, (3) provide researchers and practitioners with a differentiated view of students’ SRL (to diagnose and remediate SRL).
- The current inventory can be easily adapted to other contexts or domains than the academic homework context.</td></tr>
<tr><td>4</td><td>- The use of think-aloud protocols (TAPs) is a valuable method to gain detailed data on fifth and sixth graders’ SRL during task performance.
- The interrater reliability was satisfying.</td><td>- TAP should be supplemented with other measures (e.g., self-report questionnaires, microanalytic protocols) to assess motivational aspects, as the latter were difficult to capture by means of TAPs, presumable due to their more unconscious nature.
- TAPs do not provide insights in the underlying motives of certain behaviour nor in the causes of limited or inefficient learning behaviour.</td><td>- This study provides further information regarding the use of TAPs with a relatively young age group, confirming that late primary school children are able to verbalise their ongoing thoughts and behaviour after training.
- The detailed and fine-grained information obtained through TAP can inform further promotion and instruction of SRL (see implications provided based on CH4 with regard to RG2).</td></tr>
</table>

Research subgoal 2: Baseline assessment			
2	- Fifth and sixth graders reported good to high learning motivation. - Fifth and sixth graders reported high metacognitive awareness. - Based on structured interviews, fifth and sixth graders reported a variety of strategies to regulate their learning at pretest. - Fifth and sixth graders most frequently reported strategies of 'self-evaluation', 'goal setting and planning', and 'environmental structuring'. Qualitative analysis, however, showed that these strategies are performed on rather basic level.	- Self-report measures should be supplemented with measures assessing SRL concurrent to task execution. - Given the shortage of instruments for assessing SRL among primary school children, the development of both quantitative and qualitative instruments for this age group is wanted. - Further research using structured interviews are encouraged to not only perform quantitative analyses involving numerical rates of occurrence, but also to conduct qualitative analysis of the nature of the reported strategies..	- This study extends recent research findings in the emerging research area focusing on primary school children's SRL by reporting on at-risk late primary school children's SRL and by documenting that they are able to perform self-regulated learning strategies.
3	- At-risk students reported moderate to relatively high levels of SRL, but there is still room for improvement, especially among more deep-level strategies, like deep-level learning strategies or self-evaluation of process. - Boys showed significantly (1) lower scores on planning, self-efficacy regulation, identified regulation persistence, surface-level learning strategies, deep-level learning strategies, monitoring, product evaluation and (2) higher scores on external regulation.	- While recognizing the drawbacks of self-report inventories, also the value of these measures to gain insight into students' own perceptions is postulated. Triangulating these data sources with data of on-line methods is advised to obtain a broader and more in-depth view on students' SRL.	- This study corroborates that SRL can be expected among late primary students, but simultaneously illustrates the importance for support on SRL.
4	- Students displayed SRL but on a rather limited and basic level. - Except for a significant increase in 'making notes' and some subtle, minor qualitative improvements, students' SRL remained stable over time. More specifically, motivational activities were rarely observed. Metacognitive activities were more frequently observed during solving a Sudoku than during text studying. Moreover, these activities were dominated by monitoring activities while students pay comparatively little attention to forethought and planning or reflection activities. This was especially the case during text studying. During solving the Sudoku monitoring was more often combined with adjusting strategy use than during text studying. - As to the cognitive learning strategies, students	- The current study was performed using a small number of participants in a specific context and from a specific student population. Further large-scale research addressing different student populations, varying contexts and tasks is needed. - While the current study could depict the difficulties students face in regulating their learning, additional variables should be taken into account to provide more insight in why students show these breakdowns. - No learning outcomes were measured. A further exploration of the effectiveness of SRL strategies by incorporating learning outcomes is needed.	- This study confirms that fifth and sixth graders are capable of performing SRL, but not yet on a highly qualitative level. - As fifth and sixth graders with a low socio-economic and/or immigrant background show a rather limited and superficial use of SRL and little to no improvements over time, additional instruction and support is needed. - Given the observed individual variability in SRL, instruction and support should take students' individual difference into account. - Based on the findings regarding the task-specificity of SRL (solving a Sudoko vs. text studying), it is advisable to embed the

	mainly preferred rehearsal strategies. The majority of students supplemented these strategies with organizational strategies when progressing through 5th and 6th grade. - Motivational aspects of SRL were hardly ever observed.	- Further research should supplement the current analyses with more profound qualitative analyses, such as process mining techniques.	promotion of SRL across different subject areas and tasks. - Given the finding that SRL is not likely to develop automatically, continuous, structured, and consequent attention to the promotion of SRL is important. - As students encounter difficulties to simultaneously integrate metacognitive, motivational, and cognitive activities, teachers are encouraged to stimulate the three components of SRL simultaneously during instruction and support and to stress the interrelationship between these components/processes.
5	- Based on the CP-SRLI students report moderate to relatively high levels of SRL at pretest. - Based on teacher rating of students' SRL, students regulate their learning on moderate level. - Based on the TAP, a more nuanced picture of students' SRL arises. - Across both tasks at pretest, metacognitive activities are dominated by monitoring and adjusting strategy use. Further, preparatory metacognitive activities (e.g., task orientation, planning) and self-evaluation are observed to a limited extent. Moreover, rather basic forms of metacognitive activities were observed and these activities were observed more frequently during solving a Sudoku than during text studying. - During text studying at pretest, students' actions were dominated by cognitive strategy use of which rehearsal strategies and organisation strategies were most frequently demonstrated. - Across both tasks, TAP analysis revealed very limited motivational aspects of SRL (e.g., motivational strategies, reflections on competence). - The discrepancy between the self-reports and TAPs confirms the tendency of students to overestimate their actual strategy use. - Four motivational profiles were found: (a) a high quantity motivation group (i.e., high levels of motivation and self-efficacy beliefs; HMS); (b) a moderate quality motivation group (i.e., moderate	- This study illustrates the added value of combining different measures to assess SRL	- The descriptive findings confirm that late primary school children from low socio-economic and/or immigrant families are capable of performing SRL. However, they encounter difficulties regulating their learning purposefully and profoundly. This advocates the need for additional support. - Given students tendency to overestimate their strategy use and the assumption that students' own perceptions of SRL strategy use can influence their propensity to adjust their learning behaviour, confronting students with the differences between their perceptions and their actual use at the beginning of intervention appears advisable. - As a person-centred approach is mainly conducted in studies on older students, this study also illustrate that this approach is also interesting among younger students., namely late primary students.

	levels of autonomous motivation and self-efficacy beliefs; MMS); (c) a low quantity motivation group (i.e., low levels of motivation and self-efficacy beliefs; LMS); and (d) a good quality motivation group (i.e., high levels of autonomous motivation and self-efficacy beliefs; GMS). Students with an LMS profile reported the lowest use of SRL.		
Research subgoal 3: Effectiveness of student tutoring on SRL			
2	- For fifth graders no significant effects on learning motivation and metacognitive awareness were found. - No significant effects for fifth graders were found regarding the reported strategies during the structured interview. However, a marginal significant positive evolution regarding fifth graders' self-reported use of organising and transforming' was found. - Sixth graders show a positive increase in learning motivation and metacognitive awareness after the intervention. - Regarding the reported strategies during the structured interview, a significant decrease in social assistance from teachers and adults was observed for sixth graders. - Based on qualitative analysis of the reported strategies during the structured interview, students approaches towards 'self-evaluation', 'goal setting and planning', 'environmental structuring', and 'rehearsing and memorising' was found to be more refined, profound, reflecting a more broad repertoire of strategies, and more diverse across students.	- The sample size was rather small, no long-term effects were studied, and no control condition was included in this study. Large-scale interventions applying a quasi-experimental study with pretest, posttest, and retention test group design is recommended. - Given the small to medium effect sizes, further research on identifying key components of effective student tutoring programmes focusing on promoting higher-level skills is needed.	- Based on the positive effects on motivation, incorporating students' need for encouragement and motivational support into SRL interventions is recommended, especially among at-risk children. - The effectiveness of student tutoring on SRL has not been explored yet. By illustrating some beneficial effects on SRL, this study enters upon an unexplored research topic both in the research field regarding the promotion of SRL as in research regarding student tutoring. - As the strategies on which a substantial qualitative shift was found largely overlap with strategies explicitly addressed during the intervention, the developed curriculum script can be incorporated in future interventions.
5	- Based on teacher ratings, a positive effects was found for the experimental group from pre- to posttest, but this effect was not maintained at retention test. - Based on the CP-SRLI, only a significant higher increase of external motivation from pre- to posttest was found for the experimental group. No other significant trends were found, but large variations between individual student patterns were observed. - Based on TAPs, no significant positive effects for the experimental condition was found for SRL during solving a Sudoku. For text studying, only a significant	- In the current TAP analysis only the occurrence of strategies was analysed to investigate the effects of student tutoring. More in-depth qualitative analysis of protocols, as well as other methods to reveal the quality of students SRL use (e.g., trace methodology), could provide more detailed information. - Although a pre- post- retention test design was used, investigating the effects on longer terms might be necessary as	- Long-term support combining different instructional approaches will be necessary to effect meaningful changes in SRL among at-risk students. - Investigating whether the effectiveness of student tutoring varies according to students' motivational profile is a unique approach and current findings support further examination of this matter. - Student tutoring seems most beneficial for improving motivational aspects of SRL

	decrease of memorising was found from pre-to posttest for the control group. - Based on teacher ratings no significant relationship was found between students' motivational profile and their responsiveness to the intervention. - Based on the CP-SRLI, a negative effect was found regarding persistence and self-efficacy regulation for students with an HMS and GMS profile, respectively. In contrast, students with an LMS profile reported higher intrinsic motivation, persistence, and higher confidence in regulating their learning, after the intervention.	SRL intervention not always leads to immediate results. - The current study was rather brief to stimulate a complex skill, such as SRL, among at-risk students. Consequently, longer and more intensive interventions might be needed. - To explore whether students will be more responsive to the current SRL intervention after moving to secondary education, replication of the current study with secondary students is needed. - Further research could compare the current student tutoring programme with student tutoring interventions (1) taking into account the broader family and sociocultural context of the at-risk tutees; (2) engaging students with a middle to high socio-economic status and native background; (3) using an on-to-one tutoring setting.	among low motivated students.
Research subgoal 4: Studying tutoring processes during student tutoring focusing on SRL			
6	- No clear dominance of the tutor was observed: tutors and tutees almost equally contributed to the sessions - Findings support the notion that student tutoring provides tutees with more opportunities to engage more actively in learning than would be possible in whole classrooms. Similarly, tutees were able to ask more questions than would be feasible in a whole class setting. However, the questions were rather superficial. - In general, the tutor dialogue can be typified as more interaction-centred. Tutors adopted a more interactive style, used a wide range of activities with questioning and facilitation as the most frequent observed actions. The quality of questioning and feedback could, however, be improved. - Tutees' engaged most frequently in 'task-related actions' and in 'providing answers and explanations'. - During the tutoring sessions the focus was more on conveying strategy knowledge than on the application	- Given the small sample of the current study, further research engaging a larger amount of tutoring groups and comparing the current student programme with different tutoring designs (e.g., one-to-one vs. small group setting, well-structured vs. more open-ended tutoring, disadvantaged tutees vs. mainstream students) is advised. - As no outcome-related variables were included, no empirical claims regarding which actions are most effective to stimulate SRL could be provided. By combining process data with outcome data future research could shed light on this matter. - Supplementing the current coding with episode coding would make it possible to study the degree of adaptiveness of the	- This study provides a first exploration of tutoring processes within student tutoring focusing on SRL, an underexplored research area in tutoring research. - The study shows that with adequate training unskilled tutors can provide quite qualitative tutoring mainly characterised by an interaction-centred approach to tutoring. Supplementing the current tutor training and support, with more hands-on practice opportunities might further improve the quality of tutoring. - Tutors should be encouraged to provide sufficient practice opportunities besides focusing on conveying strategy knowledge.

	and practice of SRL. - While tutees were highly responsive to tutor questions, tutor feedback elicited less constructive responses. - Although dominant types of preceding and subsequent actions on tutor moves were found, also a range of different actions were observed. - Findings do not support a shift from external regulation to self-regulation through a phase of co-regulation. Instead, a dominance of co-regulation from the onset until the end of the tutoring programme was observed. Although some movements towards growing SRL among tutees were observed, no strong evidence of tutees' increasing SRL behaviour was found.	provided tutor support in more depth.

Nederlandstalige samenvatting
Summary in Dutch

Nederlandstalige samenvatting

De uitdaging om zelfregulerend leren van kinderen aan het eind van de lagere school te meten en te bevorderen. Een verkenning van de impact van student tutoring.

Inleiding

Gekenmerkt door een exponentiële groei aan kennis, informatie en technologische ontwikkelingen stelt de huidige kennismaatschappij nieuwe verwachtingen (Anderson, 2008; Cornford, 2002). Er wordt van mensen verwacht dat ze kunnen omgaan met de steeds veranderende toevloed aan informatie en dat ze die informatie op een zelfstandige manier kunnen verwerven en verwerken. In het licht van deze ontwikkelingen wint levenslang leren internationaal steeds meer aan belang. Hierbij wordt verwacht wordt dat mensen vaardigheden ontwikkelen die ze niet enkel in schoolse context kunnen gebruiken, maar hun hele leven lang (Cornford, 2002). Zelfregulerend leren (ZRL) wordt gezien als een belangrijke basis voor de ontwikkeling van levenslang leren (Artelt, Baumert, McElvany, & Peschar, 2003; Dignath, Buettner, & Langfeldt, 2008). ZRL verwijst naar een 'actief en constructief proces waarbij leerlingen leerdoelen vooropstellen en dan trachten om hun cognitie, motivatie en gedrag bij te sturen, te reguleren en te controleren en dit alles rekening houdend met hun doelen en de leercontext' (Pintrich, 2000, p. 453). Deze omschrijving weerspiegelt de drie hoofdcomponenten van ZRL, namelijk een metacognitieve (bv. oriëntatie, planning), cognitieve (bv. herhalings- en organisatiestrategieën) en motivationele component (bv. eigen bekwaamheidspercepties en motivatiestrategieën). ZRL wordt niet alleen gezien als een essentiële basis voor levenslang leren. Onderzoek wijst ook op een positieve impact van ZRL op schoolprestaties van leerlingen (Pintrich, 2004; Winne, 2005). Dit zorgde er mede voor dat ZRL een belangrijk onderwijsdoel is geworden. In het Vlaamse onderwijslandschap weerspiegelt dit zich door de invoering van de leergebiedoverschrijdende eindtermen 'leren leren' in het lager onderwijs.

Het belang van ZRL wordt niet enkel in de onderwijspraktijk benadrukt, maar ook in de internationale literatuur. Hedendaags onderzoek is echter voornamelijk gericht op het secundair en hoger onderwijs (Dignath et al., 2008; Whitebread et al., 2009). Ondanks de recente onderzoeksbevindingen omtrent de mogelijkheden van jonge leerlingen om hun leergedrag te reguleren (Perry, Thauberger, & Hutchinson, 2010; Whitebread & Pino Pasternak, 2010) en het belang om deze vaardigheden reeds in het lager onderwijs te stimuleren (Dignath et al., 2008; Perry, Phillips, & Dowler, 2004), blijft onderzoek bij lagereschoolkinderen beperkt. Om tegemoet te komen aan de vraag naar meer onderzoek rond ZRL in het lager onderwijs, focust dit proefschrift op deze onderwijscontext. Concreet wordt er gefocust op de derde graad lager onderwijs (groep 7 en 8) gezien de beperkte onderzoeksgegevens omtrent de ontwikkeling van

ZRL wanneer deze leerlingen de belangrijke overgang naar het secundair onderwijs naderen. Bovendien is er weinig onderzoek voorhanden dat focust op groepen met een kwetsbare onderwijspositie, zoals kansarme en/of allochtone leerlingen. Dit tekort aan empirische studies inzake het ZRL van leerlingen in het lager onderwijs is enerzijds te verklaren door de conflicterende visies rond het zelfregulerend vermogen van jonge kinderen in het verleden. Anderzijds kan dit tekort ook gelinkt worden aan het tekort aan meetinstrumenten om ZRL bij deze leeftijdsgroep in kaart te brengen.

Naast het tekort aan empirische studies omtrent ZRL in het lager onderwijs, toont onderzoek ook aan dat ZRL voor een substantiële groep leerlingen niet spontaan tot stand komt. Extra ondersteuning en stimulering is vaak noodzakelijk om deze ontwikkeling te bevorderen, zeker bij leerlingen met een kwetsbare onderwijspositie (Annevirta & Vauras, 2006; Glogger, Schwonke, Holzaepfel, Nueckles, & Renkl, 2012; Veenman, van Hout-Wolters, & Afflerbach, 2006; Zimmerman, 2002). Gezien de complexiteit van zelfregulerende vaardigheden, is individuele begeleiding vaak welkom (Butler, 2002). Onderzoek toont echter aan dat leerkrachten moeilijkheden ervaren om dergelijk instructie in te bouwen tijdens hun dagelijkse klaspraktijk (Kistner et al., 2010; Spruce & Bol, 2014). In dit opzicht kan student tutoring een interessante en vernieuwende methode zijn om ZRL te stimuleren. Binnen deze methode begeleiden studenten uit het hoger onderwijs leerlingen uit het lager of secundair onderwijs in kleine groep of in een één-op-één relatie. Bovendien wordt student tutoring gezien als een waardevolle strategie om leerlingen die een moeilijkere schoolloopbaan ervaren, zoals kansarme en/of allochtone leerlingen, te ondersteunen (Barley et al., 2002; Cassio, 2008). De onderzoeksbasis van student tutoring is echter beperkt en ook de focus op ZRL binnen student tutoring projecten is nog niet eerder onderzocht. Tot slot wordt er binnen de onderzoeksliteratuur steeds meer voor geijverd om niet alleen effecten van tutoring interventies in kaart te brengen, maar ook data te verzamelen over het tutoringproces (Roscoe & Chi, 2007). Dergelijke studies stellen ons in staat om meer inzicht te verwerven over waarom bepaalde interventies een positieve impact hebben en waarom bij andere interventies effecten uitblijven.

Onderzoeksdoelen

Op basis van bovenstaande uitdagingen werden twee hoofddoelen nagestreefd in dit proefschrift. Het *meten en in kaart brengen van ZRL bij leerlingen derde graad lager onderwijs* vormde de eerste hoofddoelstelling, verder gespecificeerd aan de hand van volgende twee subdoelen:

(1) Hoewel er verscheidende instrumenten voorhanden zijn om leergedrag en -aanpak te bevragen bij oudere respondenten, is het aanbod van dergelijke instrumenten voor een jongere leeftijdsgroep beperkt (Boekaerts & Corno, 2005; Winne & Perry, 2000). Het *ontwikkelen van meetinstrumenten om ZRL te meten bij leerlingen in het vijfde en zesde leerjaar* was daarom een eerste noodzakelijke stap om ZRL bij deze groep in kaart te brengen en mogelijke interventie-effecten te onderzoeken. Gezien het belang om verschillende methoden te combineren (van Hout-Wolters, 2009; Veenman, 2005), werd een zelfrapportage vragenlijst ontwikkeld om de percepties van leerlingen over hun gebruik van zelfregulerende leerstrategieën te inventariseren (zie hoofdstuk 3), alsook een hardop-denkprotocol om ZRL te meten tijdens taakuitvoering (zie hoofdstuk 4).

(2) Om tegemoet te komen aan de vraag naar meer onderzoeksgegevens omtrent het gebruik van zelfregulerende leerstrategieën bij leerlingen in het vijfde en zesde leerjaar (Malmberg, Järvelä, & Kirschner, 2014; Perry et al., 2010), was ons tweede doel het *gebruik en de ontwikkeling van ZRL* bij deze leeftijdsgroep in kaart te brengen. Hierbij lag de focus op kansarme en/of allochtone leerlingen.

Een tweede hoofddoelstelling was de verkenning van de impact van student tutoring als methode om ZRL te stimuleren bij leerlingen aan het eind van het lager onderwijs. Volgende twee subdoelen stonden hierbij centraal:

(3) Niettegenstaande de vele effectstudies inzake peer tutoring, is er slechts beperkt onderzoek gebeurd naar de effecten van student tutoring. Bovendien focust eerder onderzoek voornamelijk op vakspecifieke inhouden als curriculum van tutoring (Gordon, Morgan, O'Malley, & Ponticell, 2007; Topping & Hill, 1995). Binnen dit proefschrift willen we de *effecten van student tutoring* als een vernieuwende aanpak om ZRL te bevorderen, onderzoeken.

(4) Gegeven de dominante focus op effectstudies binnen de onderzoeksliteratuur rond student tutoring, richtte het vierde onderzoeksdoel zich op het bestuderen van *student tutoringprocessen*.

Om deze doelen te bereiken, werden vijf empirische studies opgezet. Figuur 1 biedt een schematisch overzicht van de relatie tussen de vier onderzoeksdoelen en de verschillende studies. De eerste verkennende studie (zie hoofdstuk 2) fungeerde als vertrekbasis voor de verdere studies. Zo gaf deze studie al een eerste zicht op ZRL bij kansarme en/of allochtone leerlingen aan het eind van het lager onderwijs (cfr. onderzoeksdoel 2). Daarnaast leverde de studie indicaties op in verband met de effectiviteit van student tutoring (cfr. onderzoeksdoel 3). Deze studie zette de nood aan meetinstrumenten ook extra in de verf. Daarom werden twee meetinstrumenten ontwikkeld die in hoofdstuk 3 en 4 besproken worden (cfr. onderzoeksdoel 1). Beide studies bieden ook meer inzicht in het zelfregulerend leergedrag van de kinderen (cfr. onderzoeksdoel 2). Verder bouwend op de pilootstudie en gebruik makend van de ontwikkelde meetinstrumenten werden in een grootschaliger interventieonderzoek de effecten van student tutoring verder onderzocht (zie hoofdstuk 5). Hoewel deze studie aan de hand van de pretestgegevens ook tegemoet komt aan het tweede onderzoeksdoel, ligt de focus voornamelijk op het in kaart brengen van de impact van student tutoring op het zelfregulerend leergedrag van kansarme en/of allochtone leerlingen (cfr. onderzoeksdoel 3). Tot slot, in lijn met onderzoeksdoel 4, werd een laatste studie opgezet om de interactieprocessen tussen tutor en tutees te bestuderen (zie hoofdstuk 6).

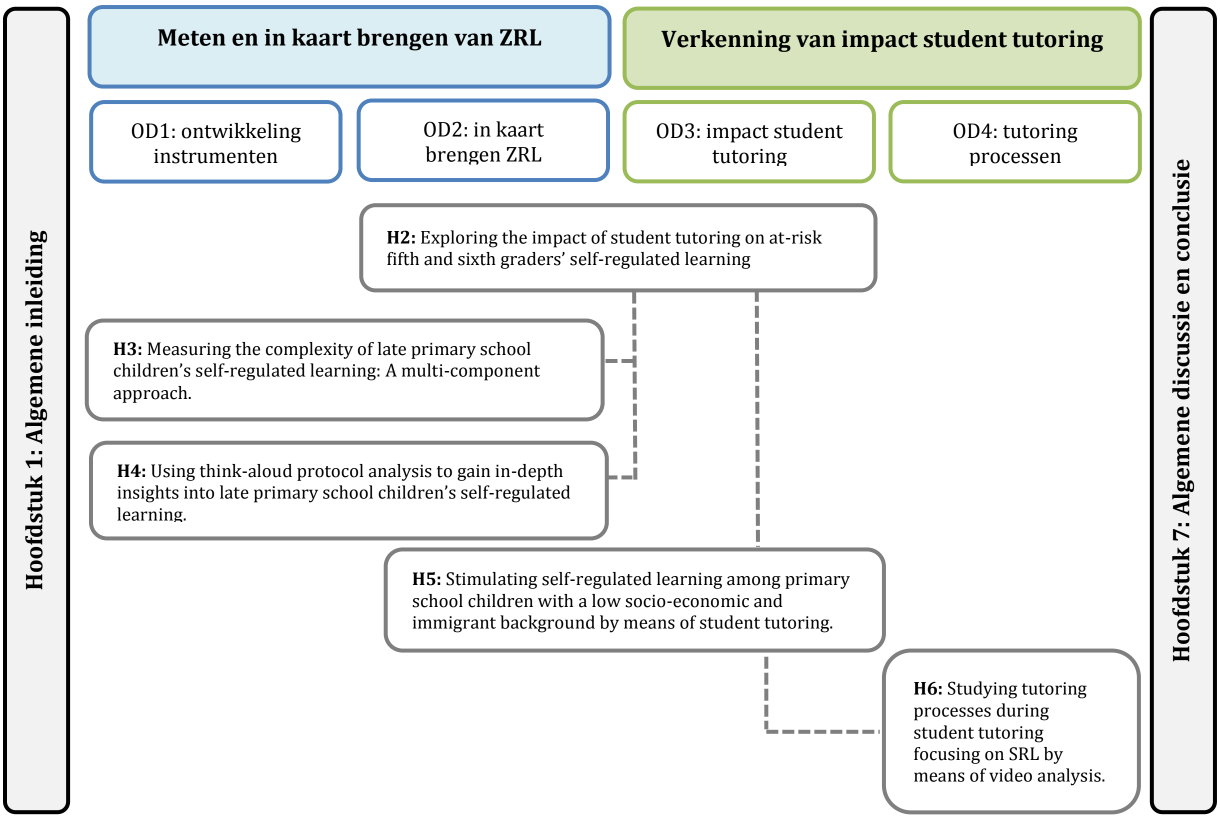

Figure 1. Overzicht van de studies en hun relatie met de onderzoeksdoelen en de verschillende hoofdstukken.
Note: OD = onderzoeksdoel, H = hoofdstuk

Overzicht en discussie van de hoofdbevindingen

Het meten en in kaart brengen van ZRL van leerlingen op het einde van het lager onderwijs

Ontwikkeling meetinstrumenten

De nood aan geschikte meetinstrumenten om ZRL bij leerlingen lager onderwijs in kaart te brengen, werd bevestigd in de pilootstudie (zie hoofdstuk 2 en 'elaboration on SRL instruments used in pilot study' in hoofdstuk 7). ZRL kan op verschillende manieren in kaart worden gebracht, gaande van observaties, trace methodologie, interviews, hardop-denk methoden tot vragenlijsten (Boekaerts & Corno, 2005; van Hout-Wolters, 2009; Veenman et al., 2006). Om grootschalig onderzoek omtrent ZRL mogelijk te maken, lijkt een zelfrapportage vragenlijst de meest aangewezen optie (Cromley & Azevedo, 2011; Winne & Perry, 2000). Hoewel er reeds verscheidende zelfrapportage vragenlijsten voorhanden zijn om het leergedrag en de leeraanpak te bevragen bij oudere respondenten (secundair of hoger onderwijs), is het aanbod van dergelijke instrumenten voor een jongere leeftijdsgroep beperkt (Winne & Perry, 2000). Bovendien beperken bestaande instrumenten zich vaak tot de cognitieve en/of metacognitieve aspecten van ZRL (Schellings, 2011; Wirth & Leutner, 2008). Overeenkomstig met de huidige conceptualisering van ZRL is het echter essentieel dat het meetinstrument de verschillende componenten van ZRL omvat (Pintrich, 2004). Op basis van deze bekommernissen, was het doel een omvattende zelfrapportage vragenlijst te ontwikkelen die een set van verschillende schalen omvat om - overeenkomstig met de drie hoofdcomponenten van ZRL - de percepties van leerlingen over hun gebruik van zelfregulerende leerstrategieëen te bevragen.

In hoofdstuk 3 wordt de ontwikkeling en validering van deze zelfrapportage vragenlijst, Children's Perceived use of Self-Regulated Learning Inventory (CP-SRLI), beschreven. Bij het ontwikkelen van deze vragenlijst werden verschillende stappen doorlopen (Worthington & Whittaker, 2006). Ten eerste vormde het theoretisch referentiekader van Pintrich (2004) de basis voor het ontwikkelen van de vragenlijst. Rekening houdend met de huidige literatuur en de doelgroep (lagereschoolkinderen), werd dit referentiekader vereenvoudigd. Er werden negen componenten geselecteerd: taakoriëntatie, planning, motivatie, eigen bekwaamheidspercepties, leerstrategieën, monitoring, motivatiestrategieën, doorzettingsvermogen en zelfevaluatie. Overeenkomstig met de conceptualisering van deze negen componenten, werden in een volgende stap voor elk component items ontwikkeld. Dit resulteerde in een itempool van 99 items. In een derde stap werden deze items geëvalueerd door een expertpanel en een leerkrachtenpanel om de inhoudsvaliditeit en het gebruik aan het eind van de lagere school te beoordelen. Vervolgens werd bij een aantal vijfde- en zesdeklassers (n = 14) een cognitief interview afgenomen om de cognitieve validiteit van de items na te gaan (Karabenick et al., 2007). Op basis van deze panels en cognitieve interviews werd de itempool aangevuld, herwerkt en verfijnd, resulterend in 109 items. Tijdens een grootschalige studie vulden 967 leerlingen uit het vijfde en zesde leerjaar de vragenlijst in. Aan de hand van parallelanalyse en exploratieve factoranalyse werd de (uni)dimensionaliteit van de verschillende itemsets horend bij de negen componenten getest. Een confirmatorische factoranalyse op een tweede onafhankelijke steekproef van 723 vijfde- en zesdeklassers bevestigde de bekomen factorstructuur. Bijkomende analyses wezen ook op de invariantie van de factorstructuur voor meisjes en jongens. De finale versie van de vragenlijst omvat 75 items verdeeld over 15 subschalen (zie appendix van hoofdstuk 3): taakoriëntatie, planning, monitoring, motivatiestrategieën, doorzettingsvermogen, zelfevaluatie product, zelfevaluatie proces, bekwaamheidspercepties regulatie, bekwaamheidspercepties motivatie, oppervlakkige leerstrategieën, diepgaande leerstrategieën en vier subschalen om de motivatie van leerlingen in kaart te brengen overeenkomstig de zelfdeterminatietheorie (Ryan & Deci, 2000) (nl. externe regulatie, geïntrojecteerde regulatie, geïdentificeerde regulatie en intrinsieke motivatie).

Samenvattend, de resultaten wijzen erop dat de CP-SRLI een waardevol instrument is om de percepties van leerlingen over het gebruik van zelfregulerende leerstrategieën aan het eind van de lagere school in kaart te brengen. Gezien het schaarse aanbod aan instrumenten voor het meten van ZRL van jonge kinderen, kan de ontwikkeling van deze vragenlijst grootschalig onderzoek bij leerlingen in de derde graad van het lager onderwijs stimuleren. Aangezien de vragenlijst verschillende componenten van ZRL bevat, biedt het ook de mogelijkheid aan onderzoekers en leerkrachten om een gedifferentieerd beeld te krijgen van de zelfregulerende vaardigheden van leerlingen. Dit maakt het instrument tevens interessant om interventies gefocust op het bevorderen van ZRL te evalueren. Daarnaast biedt de CP-SRLI ook de mogelijkheid om de onderlinge relaties tussen de verschillende zelfregulerende componenten alsook de relatie met andere leerlingkenmerken te onderzoeken om zo verdere theorieontwikkeling betreffende het ZRL van jonge kinderen te bevorderen. Aangezien via dit instrument enkel de percepties van leerlingen over hun ZRL-gebruik in kaart worden gebracht, is het aangewezen om dit perspectief aan te vullen met bijkomende databronnen (Veenman et al., 2006). Binnen dit proefschrift hebben wij ervoor geopteerd om deze data aan te vullen met hardop-denk methodologie.

Tijdens de hardop-denk methodologie wordt aan de participanten gevraagd om tijdens het uitvoeren van een leertaak hardop te denken. Een belangrijke meerwaarde van deze methode is dat het informatie verschaft over leeractiviteiten op het moment dat ze plaatsvinden (van Hout-Wolters, 2009; Veenman, 2005). Binnen de studies opgenomen in dit proefschrift werd aan de leerlingen gevraagd om twee taken te maken, namelijk het oplossen van een Sudoku en het instuderen van een informatieve tekst. Om de authenticiteit van de taken te verhogen, werden deze taken aan de leerlingen voorgesteld als huistaken van hun leerkracht. Met het oog op de analyse van de verkregen data werd een gedetailleerd codeerschema opgesteld, dit zowel vanuit de theorie als vanuit de data. In lijn met de CP-SRLI vormde het vereenvoudigde theoretisch referentiekader van Pintrich (2000, 2004) de conceptuele basis voor het codeerschema. In een volgende stap werd de brede waaier aan leeractiviteiten geïnventariseerd (Chi, 2006) en gecategoriseerd volgens de negen componenten van dit raamwerk. De meerderheid van de componenten uit de zelfrapportage vragenlijst waren eveneens toepasbaar op de hardop-denk data. Er zijn echter ook een aantal verschillen op te merken. In de hardop-denk data werden bijvoorbeeld geen uitingen rond doorzettingsvermogen gevonden. Ook gaven de leerlingen niet spontaan uiting aan hun motivatieredenen om zich te engageren voor de leertaken, waardoor ook leermotivatie - zoals geconceptualiseerd in de vragenlijst - niet opgenomen is in het codeerschema voor de hardop-denk data. Met betrekking tot de leerstrategieën, is de categorisering in herhalings-, organisatie- en elaboratiestrategieën wel terug te vinden in het codeerschema voor de hardop-denk data, terwijl deze laatst genoemde categorieën in de CP-SRLI vervat zitten onder de subschaal ‘diepgaande leerstrategieën’. Tot slot vormde de categorie ‘aanpassing strategiegebruik’ een bijkomende categorie binnen het codeerschema. Samenvattend, het codeerschema bevat tien hoofdcategorieën (zie appendix in hoofdstuk 3): taakoriëntatie, planning, bekwaamheidspercepties, herhalingsstrategieën, organisatiestrategieën, elaboratiestrategieën, motivatiestrategieën, monitoring, aanpassing strategiegebruik en zelfevaluatie. Deze hoofdcategorieën werden verder geconcretiseerd aan de hand van subcategorieën en specifieke gedragsindicatoren. Deze structuur maakt het mogelijk om zowel op macroniveau (nl. hoofdcategorieën) als op microniveau (nl. specifieke indicatoren) het zelfregulerend strategiegebruik van leerlingen te beschrijven. Zoals gerapporteerd in hoofdstuk 4 en 5 werd een hoge interbeoordelaarsbetrouwbaarheid gevonden bij het gebruik van het codeerschema voor de hardop-denk protocollen. Terwijl de hardop-denk methode voornamelijk bij oudere respondenten werd toegepast in eerder onderzoek, illustreren de huidige resultaten dat deze methode ook kan aangewend worden om de zelfregulerende leerstrategieën van jongere respondenten te bestuderen. Zoals verderop beschreven, verschaft de hardop-denk methode een gedetailleerd beeld van het ZRL van leerlingen.

Het in kaart brengen van ZRL aan het eind van het lager onderwijs

Gebruikmakend van de hierboven beschreven meetinstrumenten werd het ZRL van kansarme en/of allochtone leerlingen uit derde graad lager onderwijs in kaart gebracht. Het doel was om meer inzicht te krijgen in de mate waarin en de manier waarop deze leerlingen hun leergedrag aanpakken en reguleren. Op basis van de beschrijvende data van de CP-SRLI (zie hoofdstuk 3 en hoofdstuk 5), kan het zelfregulerend leergedrag van de bevraagde leerlingen tijdens het maken van schoolwerk als volgt omschreven worden. Voor ze starten aan een leertaak oriënteren ze zich meestal op de taak en stellen ze een planning op. Het persoonlijk belangrijk of het zinvol vinden van een leertaak (nl. geïdentificeerde regulatie), gevolgd door intrinsieke motivatie zijn de belangrijkste motivatieredenen voor leerlingen om zich in te zetten voor een taak. Ze voelen zich competenter om hun motivatie te reguleren dan om cognitieve of metacognitieve aspecten van ZRL te reguleren. Verder rapporteren de leerlingen een hoge mate van doorzettingsvermogen. Tijdens het maken van een taak geven ze aan hun aanpak in beperkte mate te monitoren, maar wel vaak motivatiestrategieën toe te passen. Ze lijken ook meer te opteren voor oppervlakkige leerstrategieën dan voor diepgaande leerstrategieën. Na het voltooien van een taak evalueren ze hun taak vaker met betrekking tot het afgewerkte product dan te reflecteren over het doorlopen leerproces.

Dit eerder optimistisch beeld dient echter gelinkt te worden aan het effectief gebruik van zelfregulerende leerstrategieën zoals in kaart gebracht aan de hand van de hardop-denk methode (zie hoofdstuk 4 en 5). Ten eerste bevestigen deze resultaten, in lijn met CP-SRLI resultaten en eerder onderzoek (Annevirta & Vauras, 2006; Cooper & Corpus, 2009; Neuenhaus, Artelt, Lingel, & Schneider, 2011; Whitebread & Pino Pasternak, 2010; Wigfield, Klauda, & Cambria, 2011), dat leerlingen aan het eind van de lagere school wel degelijk zelfregulerende leerstrategieën hanteren. Een meer diepgaande analyse van de hardop-denk data toont echter dat deze strategieën op een eerder oppervlakkige manier tot uiting komen en doorgaans in tamelijk beperkte mate. Ook de kwalitatieve analyse van het gestructureerde interview uit de pilootstudie bevestigt dat leerlingen het moeilijk hebben om de strategieën op een adequate en kwaliteitsvolle manier toe te passen. Deze resultaten zijn in lijn met eerder onderzoek (Boekaerts, 2007; Glogger et al., 2012; Merchie & Van Keer, 2014).

Volgende paragrafen bevatten een meer gedetailleerde bespreking van de hardop-denk resultaten, geclusterd volgens de drie hoofdcomponenten van ZRL. Met betrekking tot de metacognitieve aspecten van ZRL tonen de resultaten ten eerste een dominant gebruik van monitoringactiviteiten, gevolgd door het aanpassen van strategiegebruik. Taakoriëntatie, planning en zelfevaluatie worden daarentegen slechts beperkt of op heel onregelmatige basis toegepast door de leerlingen. De hoge frequentie van monitoringgedrag is in lijn met eerder onderzoek en kan gekaderd worden binnen het gegeven dat monitoring inherent deel uitmaakt van elke leerfase, terwijl oriëntatie, planning en evaluatiestrategieën vaak slechts ofwel voor of na het maken van een taak plaatsvinden (Azevedo, Winters, & Moos, 2004; De Backer, Van Keer, & Valcke, 2012; Meijer, Veenman, & van Hout-Wolters, 2006). De bevinding dat leerlingen voornamelijk gericht zijn op zelfregulerende processen binnen de uitvoeringsfase van een taak, kan ook gelinkt worden aan het feit dat leerkrachten geneigd zijn om deze processen meer te stimuleren in hun lessen dan planning of evaluatie (Spruce & Bol, 2014).

Wanneer de subcategorieën uit het codeerschema ook mee in rekening worden gebracht, valt op te merken dat de gehanteerde metacognitieve activiteiten eerder oppervlakkig van aard zijn. Tijdens het oriënteren op een taak gaan de leerlingen bijvoorbeeld vaak niet verder dan het lezen van de taakinstructies en besteden ze bijgevolg weinig aandacht aan het activeren van hun voorkennis of taakpercepties. Bovendien staan leerlingen maar zelden langer stil bij de taakinstructies door deze bijvoorbeeld te parafraseren of de voorbeelden van de oefening te bekijken. Monitoren wordt bij het oplossen van de Sudoku voornamelijk ingevuld door het identificeren van fouten en tijdens het instuderen van de tekst als het nakijken of de tekst juist is gememoriseerd. Meer diepgaande vormen van monitoring, zoals kritisch reflecteren over de strategieaanpak of de beschikbare tijd in de gaten houden, werden zelden geobserveerd. Net als in de vragenlijstresultaten, zagen we ook bij de hardop-denk opdracht voornamelijk evaluaties met betrekking tot het leerproduct (bv. 'Heb ik alle vakjes van de Sudoko ingevuld?') en uiterst zelden met betrekking tot het leerproces (bv. 'Ik heb de tekst op een goede manier gestudeerd'). Verder pasten de leerlingen de metacognitieve activiteiten vaker toe tijdens het oplossen van de Sudoku dan tijdens het instuderen van de tekst, wat bevestigt dat deze metacognitieve activiteiten kunnen variëren naargelang het domein of de taak (Alexander, Dinsmore, Parkinson, & Winters, 2011; Braten & Samuelstuen, 2004).

Met betrekking tot de cognitieve leerstrategieën, tonen de resultaten dat de leerlingen er eerder een eenzijdige benadering op nahouden. Ze focussen voornamelijk op oppervlakkige leerstrategieën met als doel een basisbegrip van de tekst te verwerven of de tekst te memoriseren. Diepgaande leerstrategieën om informatie te organiseren of toe te passen, komen in veel mindere mate voor. Deze bevindingen zijn ook in lijn met de zelfrapportage gegevens waarin leerlingen te kennen geven frequenter oppervlakkige dan diepgaande leerstrategieën te gebruiken. Bovendien blijkt uit de huidige resultaten dat leerlingen moeilijkheden ondervinden om deze leerstrategieën (bv. kernwoorden aanduiden, linken leggen tussen de verschillende tekstonderdelen) op een adequate manier toe te passen (Broekkamp & van Hout-Wolters, 2007; Meneghetti, De Beni, & Cornoldi, 2007; Merchie & Van Keer, 2014).

Tot slot werden aan de hand van de hardop-denk methode weinig motivationele aspecten van ZRL geïdentificeerd. De onderzochte leerlingen uiten zelden tot nooit taakpercepties, reflecteren bijna nooit over hun competentie, gebruiken zelden motivatiestrategieën en uiten geen affectieve reacties na het voltooien van een taak. Dit is mogelijk te verklaren door het meer onbewuste karakter van motivatieprocessen (Bannert & Mengelkamp, 2008; Merchie & Van Keer, 2014; Wolters, Bezon, & Arroyo-Giner, 2011).

Naast informatie over het gebruik van zelfregulerende strategieën, illustreren de hardop-denk resultaten ook de individuele verschillen tussen leerlingen (Annevirta & Vauras, 2006; Winne, 2005; Zimmerman, 2002). Enkele eerste indicaties van factoren die met deze verschillen samenhangen, werden gevonden in hoofdstuk 3 en 5. In hoofdstuk 3 toonden analyses in verband met verschillen tussen jongens en meisjes aan dat jongens in minder mate rapporteren volgende strategieën te gebruiken: taakoriëntatie, planning, oppervlakkige en diepgaande leerstrategieën, doorzettingsvermogen, monitoring, en productevaluatie. Bovendien lijken jongens in hogere mate gemotiveerd omwille van externe redenen, terwijl meisje vaker gemotiveerd zijn omwille van de persoonlijk meerwaarde van taken. In hoofdstuk 5 werden op basis van een clusteranalyse op de subschalen met betrekking tot bekwaamheidspercepties en motivatie vier motivatieprofielen gevonden. Uit de verdere analyses bleek dat leerlingen met een laag motivatieprofiel significant lager scoorden op de metacognitieve en cognitieve variabelen van de CP-SRLI.

In hoofdstuk 4 werd - weliswaar bij een beperkte steekproef - ook onderzocht hoe het ZRL van leerlingen evolueert doorheen het vijfde en zesde leerjaar. Deze longitudinale resultaten toonden niet enkel individuele verschillen in de ontwikkeling van ZRL, maar ze toonden ook aan dat het gebruik van zelfregulerende leerstrategieën in het algemeen weinig substantiële veranderingen kende. Met uitzondering van een toename in het maken van notities en enkele subtiele kwalitatieve verbeteringen, bleef het ZRL van de leerlingen vrij stabiel over twee schooljaren. Dit gaat in tegen de verwachtingen dat leerlingen uit de derde graad van het lager onderwijs - in voorbereiding op de overgang naar secundair onderwijs - hun strategierepertoire zouden uitbreiden en adequater toepassen (Cleary & Zimmerman, 2004; Hamman, Berthelot, Saia, & Crowley, 2000; Meneghetti et al., 2007). Deze bevindingen kunnen eventueel verklaard worden door de vaststelling dat er bij veel leerlingen, naarmate ze verder vorderen in het lager onderwijs, een dalende motivatie en een dalend geloof in hun competentie om hun leren te reguleren vast te stellen is (Corpus, McClintic-Gilbert, & Hayenga, 2009; Usher & Pajares, 2006). Deze dalende motivatie en bekwaamheidspercepties kunnen een negatieve invloed uitoefenen op de keuze van leerlingen om op een actieve en zelfstandige manier hun leren te reguleren (Urdan & Midgley, 2003; Zimmerman, 2011). Deze tegengesteld krachten, in combinatie met een te beperkte stimulering in de klas, zouden ervoor kunnen zorgen dat leerlingen weinig spontane ontwikkelingen vertonen in ZRL.

Eindbeschouwingen inzake het meten en in kaart brengen van ZRL

Met betrekking tot het meten van zelfregulerende leerstrategieën, bevestigen de huidige resultaten de meerwaarde om meerdere meetinstrumenten te combineren. Op die manier kunnen onderzoekers verder bouwen op de sterke punten van de ontwikkelde instrumenten om zo een breder en diepgaander inzicht te verwerven in het zelfregulerend strategiegebruik van leerlingen. Hoewel bepaalde overeenkomsten tussen de zelfrapportage gegevens en hardop-denk gegevens werden gevonden, bevestigen de resultaten dat leerlingen niet altijd doen wat ze zeggen en dat ze vaak hun strategiegebruik overschatten (Cromley & Azevedo, 2006; Schellings & van Hout-Wolters, 2011). Dit hoeft echter niet te betekenen dat zelfrapportage gegevens niet waardevol zijn om zicht te krijgen op het ZRL van leerlingen. Hun percepties bieden namelijk inzicht in hoe leerlingen zelf hun strategiegebruik inschatten (Perry & Winne, 2006; Zimmerman, 2008). Wanneer leerlingen hun leergedrag reguleren doen ze dit ook in aansluiting met deze percepties. Dit betekent dat over- of onderschattingen kunnen leiden tot hardnekkig gebruik van inefficiënte of ongepaste strategieën aangezien leerlingen de nood niet ervaren om hun leergedrag te veranderen. Dit impliceert ook een aanbeveling naar de praktijk, met name dat het aangewezen kan zijn om de percepties van leerlingen te confronteren met hun gedrag om zo een correcter beeld over hun ZRL-gedrag te verkrijgen als vertrekbasis voor training en instructie. Hoewel de onderzoeken binnen dit proefschrift de voordelen van de hardop-denk methode bevestigen, bleek deze methode wel minder geschikt om motivationele aspecten van ZRL in kaart te brengen. In dit opzicht kan de CP-SRLI aanvullend zijn om meer inzicht te krijgen in de motivatie en het gebruik van motivatiestrategieën van leerlingen.

Verder onderstrepen de beschrijvende en longitudinale bevindingen het belang om kansarme en/of allochtone leerlingen aan het eind van het lager onderwijs te ondersteunen om hun zelfregulerende vaardigheden te verfijnen en verder te ontwikkelen. Hierbij zal het belangrijk zijn om de individuele verschillen in rekening te brengen. Ook dient er voldoende aandacht besteed te worden aan de voorbereidende en evaluerende fase binnen een leertaak. Tot slot benadrukken de resultaten het belang om de instructie over en de aandacht voor ZRL op een continue en structurele manier en binnen een variëteit aan contexten in te bouwen in de dagelijkse klaspraktijk.

Een verkenning van de impact van student tutoring als methode om ZRL te bevorderen

Binnen dit proefschrift worden de effecten van één specifiek student tutoringproject onderzocht, namelijk het TutorBabbel-project. Dit project is een samenwerking tussen Gentse basisscholen met een hoog percentage kansarme en/of allochtone leerlingen en de vakgroep Onderwijskunde (Universiteit Gent). Binnen het project begeleiden eerste masterstudenten Pedagogiek en Onderwijskunde gedurende tien sessies kansarme en/of allochtone leerlingen uit het vijfde en zesde leerjaar met een specifieke focus op ZRL. Deze sessies vinden plaats tijdens de schooluren (een keer per week gedurende twee lesuren van 50 minuten) en gebeuren in kleine groepjes van twee à drie leerlingen. Voor de tutors is het project ingebed in hun studieprogramma en is hun medewerking verbonden aan studiepunten. Om de sessies te structureren en de tutors te ondersteunen in hun opdracht werd het pakket 'Mijn TutorBabbel-boek' uitgewerkt, dat zowel didactisch klasmateriaal als leermateriaal voor de leerlingen en een bijhorende handleiding omvat. Verder ontvangen de tutors vooraf ook een training waarin belangrijke tutorvaardigheden, maar ook aandachtspunten inzake het stimuleren van ZRL aan bod komen. Ten slotte worden ze tijdens het project via verschillende manieren (bv. supervisiegesprekken, feedbackgesprekken) ondersteund.

Het doel om de effecten te verkennen van student tutoring als methode om ZRL te stimuleren, is gegroeid vanuit de veronderstelling dat de specifieke kenmerken van student tutoring overeenstemmen met kenmerken van een leeromgeving die ZRL ondersteunt. Ten eerste wordt de mogelijkheid tot meer individuele begeleiding en hulp op maat in vergelijking met de klasinstructie als een belangrijk voordeel van student tutoring beschouwd. Door de kleine groepssamenstelling zou een tutor beter in staat zijn om de beginsituatie van de leerlingen in te schatten, de instructie en begeleiding hierop af te stemmen en de zone van de naaste ontwikkeling te bewerkstelligen (Gordon et al., 2007; Graesser & McNamara, 2010). Daarnaast zou een tutorsituatie de leerlingen ook meer uitnodigen om een actieve rol op te nemen en verantwoordelijkheid over hun leerproces te dragen waarbij ze onmiddellijk en continu feedback kunnen krijgen van de tutors (Gaustad, 1992; Gordon et al., 2007). Verder zou de mogelijkheid om een vertrouwensrelatie op te bouwen met iemand die dichter bij hun leefwereld staat, het krijgen van positieve feedback en meer individuele en positieve aandacht, de motivatie en het competentiegevoel van de leerlingen bevorderen (Karsenty, 2010; Topping & Ehly, 2001).

In hoofdstuk 6 werden de interacties tussen tutor en tutees van drie groepjes gedurende het project opgevolgd. Tijdens sessie 2, 4, 6 en 8 werden de sessies gefilmd en geanalyseerd aan de hand van een gedetailleerd codeerschema. Binnen deze studie werden niet alleen de concrete acties van tutor en tutees geïdentificeerd, maar werd er ook gekeken of er over de sessies heen een verschuiving inzake eigenaarschap van regulatie te bemerken viel. Op basis van de beschrijvende resultaten werden een aantal van bovenstaande veronderstellingen bevestigd. Zo toonden de resultaten aan dat er tijdens de sessies ruimte was voor sociale en motivationele aspecten (Lepper & Woolverton, 2002; Topping & Ehly, 2001). In sterk contrast tot eerdere studies (Berghmans, Neckebroeck, Dochy, & Struyven, 2013; Chi, Siler, Jeong, Yamauchi, & Hausmann, 2001; Graesser, Person, & Magliano, 1995) werden de geobserveerde sessies niet sterk gedomineerd door de tutors, maar hadden beide actoren een eerder gelijkwaardige bijdrage tijdens de interacties. Deze bevinding, in combinatie met de vaststelling dat leerlingen meer vragen stelden tijdens de sessies dan in normale klassituaties, ondersteunt de veronderstelling dat de leerlingen meer mogelijkheden krijgen om actief deel te nemen aan het leergebeuren binnen de context van student tutoring. In het algemeen werden de sessies getypeerd door een interactieve tutorstijl waarbij de tutors trachtten om de leerlingen te activeren door vragen te stellen en ondersteuning te bieden, terwijl de leerlingen voornamelijk de rol op zich namen om de vragen te beantwoorden en toelichtingen te geven. Dit zijn opvallende en positieve bevindingen aangezien in eerder onderzoek het voornamelijk tutors waren die de functie van uitleg en toelichtingen geven op zich namen. Deze resultaten zijn mogelijks te kaderen binnen de focus op ZRL als curriculum van de sessies en de voorbereidende training die de tutors ontvingen. In deze training werd sterk de nadruk gelegd op de actieve participatie van de leerlingen en de coachende rol van tutors. Dit heeft mogelijk de percepties van de tutors over hun rol en de daarop aansluitende keuzes inzake tutorgedrag beïnvloed. Deze resultaten illustreren verder ook dat relatief onervaren tutors er met de gepaste training in slagen om de typische valkuilen van een beginnend tutor, zoals een te sterk directieve of didactische aanpak, te overwinnen (Chi et al., 2001; Graesser et al., 1995).

Hoewel een meer interactieve tutorstijl bevorderlijk wordt geacht, werd op basis van de effectstudies (zie hoofdstuk 2 en 5) geen eenduidig of sterk bewijs gevonden voor de positieve impact van student tutoring op het zelfregulerend leergedrag van kansarme en/of allochtone leerlingen aan het eind van de lagere school. Aan de hand van een pretest – posttest design werd in de pilootstudie de impact van student tutoring verkend (zie hoofdstuk 2). In deze studie werden bij 93 leerlingen twee zelfrapportage vragenlijsten, met name de Leermotivatietest (Miedema & de Vos, 2004) en Junior Metacognitive Awareness Iventory (Jr. MAI; Sperling, Howard, Miller, & Murphy, 2002), afgenomen alsook een gestructureerd interview, namelijk het Self-Regulated Learning Interview Schedule (SRLIS; Zimmerman & Pons, 1986). Op basis van paired sample t-tests werd voor de leerlingen uit het zesde leerjaar een positief effect gevonden met betrekking tot hun gerapporteerde motivatie en metacognitief bewustzijn. De paired sample t-test op de kwantitatieve gegevens van de SRLIS toonden geen significante positieve resultaten voor vijfde- en zesdeklassers. Wel werd er op basis van de kwalitatieve analyse van de SRLIS opgemerkt dat leerlingen met betrekking tot een aantal categorieën van strategieën (nl. 'zelfevaluatie', 'doelen stellen en plannen', 'organisatie leeromgeving' en 'herhalen en memoriseren') een diepgaandere aanpak hanteerden na de interventie.

Na deze eerste verkenning van de effecten in de pilootstudie werd een quasi-experimenteel repeated measures design opgezet (zie hoofdstuk 5). In totaal namen 404 leerlingen deel aan dit onderzoek waarvan 106 leerlingen gedurende tien sessies van elk 100 minuten begeleid werden door de tutors. Binnen deze studie werd ook nagegaan of leerlingen met verschillende motivatieprofielen op een verschillende manier baat hadden bij de interventie. Tijdens drie meetmomenten werd zowel aan de klasleerkrachten als aan de leerlingen een vragenlijst voorgelegd om het ZRL van de leerlingen in kaart te brengen. Aan een selectie van 38 leerlingen werd ook gevraagd om de hardop-denk taak uit te voeren. Aan de hand van mixed ANOVA werd de effecten van student tutoring onderzocht.

Op basis van de leerkrachtenvragenlijst werd een positief effect van pretest naar posttest gevonden, maar dit effect bleef echter niet behouden op lange termijn. Verder werden er in het algemeen geen positieve effecten gevonden. Wanneer echter het motivatieprofiel van de leerlingen in rekening wordt gebracht, tonen de resultaten dat de interventie voor de laag gemotiveerde leerlingen wel een aantal positieve veranderingen teweeg bracht. Zo rapporteerden deze leerlingen na de interventie in hogere mate een planning te maken, meer door te zetten, meer intrinsiek gemotiveerd te zijn en een hoger vertrouwen te hebben om hun leerproces te reguleren. Deze positieve effecten hebben voornamelijk betrekking op motivationele aspecten. Dit is ook in lijn met de resultaten van de pilootstudie waarin eveneens een positief effect op leermotivatie bij zesdeklassers gevonden werd. Ten aanzien van cognitieve leerstrategieën werden zowel in de pilootstudie als in de grootschalige interventiestudie ook enkele positieve, maar niet significante, trends geobserveerd. Aan de hand van huidige analyses van de hardop-denk data gerapporteerd in hoofdstuk 5 werd enkel de kwantiteit en niet de kwaliteit van de strategieën in rekening gebracht. Een meer kwalitatieve analyse van deze data zou waardevol zijn om een meer genuanceerd beeld te krijgen van de effecten van student tutoring (bv. als leerlingen kernwoorden aanduidden, waren zij beter in staat om hoofd- en bijzaken van elkaar te onderscheiden).

Onze resultaten verschillen sterk van de positieve effecten gerapporteerd voor tutees in eerder onderzoek (Cohen, Kulik, & Kulik, 1982; Ritter, Barnett, Denny, & Albin, 2009; Topping & Hill, 1995). Hierbij dienen wel enkele kanttekeningen te worden gemaakt. Ten eerste zijn eerdere studies en de daaraan gekoppelde positieve bevindingen bijna uitsluitend gebaseerd op studies met een focus op vakspecifieke inhouden en niet op hogerordevaardigheden, zoals ZRL. Ten tweede merkt Ritter et al. (2009) op basis van een meta-analyse op dat de algemene effectgrootte van tutoring initiatieven significant en bevredigend is, maar dat individuele studies vaak geen significante effecten weergeven en er een grote variëteit is inzake de effectgrootte van student tutoring initiatieven. Verder was het binnen dit proefschrift ook expliciet de bedoeling om sterk te focussen op ZRL als uitkomst van de interventie aangezien in eerder ZRL-interventieonderzoek vaak de focus op vakspecifieke leerwinst ligt (Veenman et al., 2006). Aangezien het niet uitzonderlijk is dat er effecten gevonden worden op leerprestaties binnen het domein waarin de ZRL-training werd gegeven en niet zozeer op ZRL zelf (Hattie, Biggs, & Purdie, 1996), zou het meenemen van de leerprestaties in toekomstig onderzoek een meer volledig beeld kunnen geven van de effecten van de huidige interventie.

In hoofdstuk 5 en 7 zijn er verschillende suggesties voor verder onderzoek opgenomen om een diepgaander inzicht te verwerven in de mogelijke meerwaarde van student tutoring als methode om ZRL te bevorderen. De processtudie (zie hoofdstuk 6) bracht alvast ook een aantal interessante aspecten aan het licht om de huidige resultaten van de effectstudie breder te kaderen. Ten eerste werd er een sterke focus op strategiekennis gevonden en meer specifiek op declaratieve en procedurele kennis. Conditionele kennis kreeg minder aandacht omdat tutors zelden expliciete instructie of bredere toelichting gaven omtrent in welke situatie en waarom het toepassen van strategieën belangrijk is. Het benadrukken van het belang van strategieën wordt echter belangrijk geacht om transfer van de geleerde strategieën naar andere leercontexten te faciliteren (de Boer, Donker-Bergstra, Kostons, Korpershoek, & van der Werf, 2012; Kistner et al., 2010; Pressley & Harris, 2006).

Ook al is aandacht voor declaratieve, procedurele en conditionele kennis belangrijk binnen ZRL-instructie (Veenman et al., 2006; Weinstein, Husman, & Dierking, 2000), dit dient ten tweede aangevuld te worden met voldoende oefenmogelijkheden in een variëteit aan contexten en leertaken. Op basis van de processtudie bleek echter dat leerlingen zelden typerende ZRL-activiteiten, zoals planning of begripsmonitoring, toepasten tijdens de sessies. Op basis van deze resultaten kan verondersteld worden dat de leerlingen te weinig mogelijkheden geboden werd om de aangereikte strategieën in te oefenen, enerzijds door de focus op strategiekennis, maar mogelijks ook omdat de tijd beperkt was binnen de relatieve korte interventieperiode. Uit bijkomende analyses bleek ook dat leerlingen zelfregulerende strategieën (bv. planning, monitoring) zelden spontaan en bijna uitsluitend op expliciete vraag van de tutors toepassen. Dit komt overeen met bevindingen uit eerder onderzoek die stellen dat zelfregulerende vaardigheden bij lagereschoolkinderen vaak geen individueel geïnitieerde activiteiten zijn, maar dat expliciete en gerichte stimulering vaak aangewezen is (Paris & Paris, 2001; Perry et al., 2010)

Tijdens dergelijke expliciete oefenmomenten is het daarnaast ook belangrijk dat leerlingen feedback ontvangen over de accuraatheid van hun strategietoepassing om zo hun strategiegebruik te verfijnen (Perry, VandeKamp, Mercer, & Nordby, 2002; Zimmerman, 2000). Met betrekking tot dit aspect bleek uit de resultaten dat tutors voornamelijk opteren voor feedback over het eindproduct. Ze investeren opmerkelijk minder in het geven van constructieve procesfeedback waarbij ze samen met de leerlingen de criteria voor een succesvol leerproduct- en proces bespreken en waarin ze informatie geven over wat de leerlingen al goed doen, wat werkpunten zijn en hoe leerlingen deze werkpunten kunnen aanpakken. Bij het faciliteren van ZRL is dergelijke feedback echter aangewezen (Hattie & Timperley, 2007; Nicol & Macfarlane-Dick, 2006).

Ten vierde wordt vanuit de literatuur aangenomen dat de ontwikkeling van ZRL start met een sterke sociale begeleiding van een model (bv. leerkracht of tutor) dat instructie geeft en het gebruik van zelfregulerende strategieën en processen demonstreert (nl. externe regulatie). De leerling neemt in deze initiële fase de rol van observator op zich. Zoals eerder vermeld, gaven de tutors weinig instructie en kon er ook weinig demonstratie of modelgedrag met betrekking tot zelfregulerende vaardigheden opgemerkt worden in het tutorgedrag. De sessies werden echter van bij de start gekenmerkt door co-regulatie. Co-regulatie verwijst naar een overgangsfase in het leerproces van leerlingen naar zelfregulatie waarbij de leerling start met het nemen van verantwoordelijkheid over zijn eigen leerproces maar wel nog ondersteunend wordt door een meer vaardig iemand (Hadwin, Oshige, Gress, & Winne, 2010). In de geobserveerde sessies is deze fase echter niet voorafgegaan door een duidelijke observatiefase. Onderzoek toont echter aan dat net voor jongere leerlingen van belang is om de essentiële kenmerken van strategiegebruik te kunnen observeren en te bemerken welke gevolgen het toepassen van de strategie bij het model teweeg brengen (Schunk & Ertmer, 2000).

Tot slot werd deze co-regulatiefase niet gevolgd door een duidelijke zelfregulatiefase. Hoewel er op basis van chi-square analyses enkele vorderingen in de richting van zelfregulatie konden waargenomen worden, toonden de resultaten geen sterke groei van zelfregulatie. Hoewel het positief is dat tutors een interactieve stijl hanteren gekenmerkt door co-regulatie, besteden ze weinig aandacht aan belangrijke instructieprincipes inzake het bevorderen van ZRL bij een jongere leeftijdsgroep. Het kan aangenomen worden dat deze interactieve tutorstijl voldoende is om vakspecifieke inhouden of lagerordevaardigheden te bevorderen, zoals ook eerder onderzoek uitwees (Chi et al., 2001), maar dat extra acties nodig zijn om significante vooruitgang te boeken in complexe vaardigheden als ZRL, zeker bij leerlingen met een kwetsbare onderwijspositie. Verder is het ook mogelijk dat de leerlingen zich nog niet voldoende competent voelden om over te gaan naar zelfregulatie waardoor tutors hun rol als co-regulator behielden.

Samenvattend, bovenstaande resultaten illustreren dat het bevorderen van ZRL een complexe en uitdagende onderneming is. Terwijl de processtudie al meer inzicht bood in het tutoringproces, benadrukte deze studie tegelijkertijd de complexiteit van deze processen. Wat het stimuleren van ZRL aan de hand van student tutoring betreft, bracht dit proefschrift ook enkele bijkomende bedenkingen en vragen naar boven die inspirerend kunnen zijn voor toekomstig onderzoek. Met betrekking tot het stimuleren van ZRL bij lagereschoolkinderen met een kwetsbare onderwijspositie, menen we dat er niet één wondermiddel zal zijn om een complexe vaardigheid als ZRL te bevorderen, maar dat een langdurige en continue stimulering van deze vaardigheden noodzakelijk is waarbij verschillende instructiemethoden worden gecombineerd. In dit opzicht worden binnen dit proefschrift verschillende mogelijkheden voor verder onderzoek geboden. Zo kan er bijvoorbeeld – overeenkomstig met de response-to-intervention methode (Fuchs & Fuchs, 2006) - onderzocht worden of student tutoring een waardevolle aanvulling kan zijn om leerlingen extra te ondersteunen wanneer deze onvoldoende gebaat zijn met kwalitatieve klasinstructie.

Algemeen besluit

Vandaag de dag wordt van leerlingen meer en meer verwacht dat ze zelfstandig aan de slag gaan, taken en opdrachten kunnen plannen, er positieve leerattidudes op na houden, de gepaste leerstrategieën kunnen selecteren en hanteren en dat ze hun eigen leerproces kunnen bijsturen en evalueren. Deze vaardigheden hebben niet enkel een positieve invloed op de leerresultaten van leerlingen, maar vormen ook een belangrijke basis voor de verdere schoolloopbaan en levenslang leren. Zowel in de internationale literatuur als in de praktijk worden deze vaardigheden als cruciaal beschouwd en wordt geopperd dat deze een expliciete plaats dienen te krijgen in het onderwijs. Jammer genoeg toont onderzoek echter aan dat veel leerlingen ermee worstelen om zich deze noodzakelijk geachte vaardigheden eigen te maken en dat ook leerkrachten het moeilijk vinden om hun leerlingen hierin adequaat te ondersteunen. Het doel van dit proefschrift was om – in aansluiting met de stijgende onderzoeksinteresse voor ZRL bij lagereschoolkinderen – verdere stappen te ondernemen om ons inzicht in het zelfregulerend gedrag van leerlingen aan het eind van de lagere school te bevorderen en te onderzoeken in welke mate en op welke manier student tutoring een bijdrage kan leveren in de zoektocht om deze vaardigheden bij kansarme en/of allochtone leerlingen te bevorderen.

De onderzoekdoelen van dit proefschrift situeren zich op het kruispunt van twee onderzoeksvelden, namelijk ZRL en student tutoring. Met de ontwikkeling van een zelfrapportage vragenlijst en een hardop-denk protocol biedt dit proefschrift een bijdrage aan de zoektocht hoe ZRL in kaart gebracht kan worden bij lagereschoolkinderen en welke voor- en nadelen verbonden zijn aan het gebruik van deze instrumenten. Op basis van deze instrumenten werden zowel kwantitatieve als kwalitatieve gegevens verzameld over de mate waarin leerlingen beschikken over ZRL. Hierbij werd specifiek gefocust op kansarme en/of allochtone leerlingen aangezien onderzoek bij deze doelgroep beperkt is ondanks indicaties in eerder onderzoek dat deze groep mogelijk meer moeilijkheden ervaart met betrekking tot ZRL. De bekomen resultaten tonen aan dat deze leerlingen wel zelfregulerende strategieën aanwenden, maar dat zij niet altijd even vaardig zijn om deze op een diepgaande en doelgerichte manier toe te passen. Verder toonden de leerlingen ook weinig spontane ontwikkeling in deze vaardigheden. Deze resultaten onderstrepen nogmaals de nood om ZRL op een expliciete en kwaliteitsvolle manier te stimuleren.

In dit opzicht werd de impact van student tutoring als innovatieve methode om ZRL te stimuleren onderzocht. De focus op ZRL als tutoringinhoud is ook vernieuwend binnen het onderzoek rond student tutoring. De opgezette studies binnen dit onderzoeksdoel toonden aan dat het bevorderen van ZRL complexer is dan aanvankelijk gedacht. Hoewel er enkele positieve effecten werden gevonden en dan voornamelijk met betrekking tot motivationele aspecten bij laaggemotiveerde leerlingen, beantwoordde student tutoring als methode om ZRL te stimuleren bij kwetsbare leerlingen niet volledig aan de verwachtingen. Aan de hand van de processtudie werden enkele mogelijke verklaringen voor deze eerder onverwachte resultaten gegeven. Verder toonde de studie ook aan dat onervaren tutors mits gepaste training en ondersteuning erin slaagden om een interactieve tutorstijl te hanteren. Gegeven de complexiteit van ZRL blijkt echter dat deze interactieve benadering moet aangevuld worden met meer doelgerichte instructieprincipes specifiek toegespitst op het bevorderen van ZRL, wat in huidige tutorsessies eerder beperkt was.

Op basis van een kritische en brede bespreking van de resultaten worden binnen dit proefschrift met betrekking tot ZRL en student tutoring verschillende pistes tot verder onderzoek geformuleerd. We hopen dat dit ertoe leidt dat ZRL en het onderzoeken van de noodzakelijke voorwaarden om tot kwalitatieve en effectieve ZRL-instructie te komen, hoog op de agenda gezet wordt bij zowel onderzoekers, beleidsmakers als praktijkmensen.

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Academic output

Academic output

Output integrated in this dissertation

Journals (a1)

Vandevelde, S., Van Keer, H., & De Wever, B. (2011). Exploring the impact of student tutoring on at-risk fifth and sixth graders' self-regulated learning. *Learning and Individual Differences, 21(4)*, 419-425. doi: 10.1016/j.lindif.2011.01.006

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Vandevelde, S., Van Keer, H., & Merchie, E. (2014). The challenge of promoting self-regulated learning among primary school children with a low socio-economic and immigrant background. Manuscript accepted for publication in *Journal of Educational Research*.

Vandevelde, S., Van Keer, H., Schellings, G. & van Hout-Wolters, B. (2015). Using think-aloud protocol analysis to gain in-depth insights into upper primary school children's self-regulated learning. Manuscript submitted for publication in *Learning and Individual differences.*

Vandevelde, S., Van Keer, H., De Backer, L., Van Steenbrugge, H., & Mertens, C. (2015). Unravelling tutoring processes during student tutoring focusing on self-regulated learning. Manuscript submitted for publication in *Cognition and Instruction.*

Conference contributions

Vandevelde, S., & Van Keer, H. (2009). *Maken tutors een verschil? Een verkenning van de impact van student tutoring op "leren leren" van leerlingen lager onderwijs*. Paper presented at the Onderwijs Research Dagen (ORD), Leuven, Belgium, 27 - 29 May 2009.

Vandevelde, S., & Van Keer, H. (2009). *Can tutors make a difference? Exploring the impact of student tutoring on fifth and sixth graders "learning to learn."* Paper presented at the European Association for Research of Learning and Instruction (EARLI) Conference, Amsterdam, The Netherlands, 25 - 28 August 2009.

Vandevelde, S., & Van Keer, H. (2011). *Het zelfregulerend leren van basisschoolkinderen in kaart gebracht*. Paper presented at the Onderwijs Research Dagen (ORD), Maastricht, The Netherlands, 8 – 10 June 2011.

Vandevelde, S., & Van Keer, H. (2011). *Studying primary school children's self-regulated learning.* Paper presented at the European Association for Research on Learning and Instruction (EARLI) Conference, Exeter, United Kingdom, 30 August - 3 September 2011.

Vandevelde, S., & Van Keer, H. (2012). *Self-regulated learning in late primary school: what can we learn from think aloud protocol analysis?* Poster presented at the SIG Metacognition EARLI 2012 conference, Milan, Italy, 5 – 8 September 2012.

Vandevelde, S., & Van Keer, H. (2013). *The challenge of promoting at-risk primary school children's self-regulated learning.* Paper presented at the symposium 'Self-regulated learning in preschool and primary school children' at the European Association for Research on Learning and Instruction (EARLI) Conference, München, Germany, 27 - 31 August 2013.

Vandevelde, S., & Van Keer, H. (2014). *Fostering at-risk elementary school children's self-regulated learning by means of student tutoring: a challenging endeavor*. Paper presented at the annual meeting of the American Educational Research Association (AERA), Philadelphia, Pennsylvania, 3 - 7 April 2014.

Vandevelde, S., & Van Keer, H. (2014). *Gaining insight into the development of at-risk late primary school children's self-regulated learning.* Paper presented at the symposium 'SRL in primary education: Studying different components of a multi-faceted process' at the SIG Metacognition EARLI 2014 conference, Istanbul, Turkey, 3 - 6 September 2014.

Vandevelde, S., & Van Keer, H. (2014). *The significant role of motivation in self-regulated learning: A person-oriented approach*. Paper presented at the SIG Metacognition EARLI 2014 conference, Istanbul, Turkey, 3 - 6 September 2014.

Vandevelde, S., & Van Keer, H. (2015). *Unravelling the tutoring processes during student tutoring*. Paper accepted to be presented at the European Association for Research on Learning and Instruction (EARLI) Conference, Limassol, Cyprus, 25 – 29 August 2015.

Other academic output

Journals (a1)

Merchie, E., Van Keer, H., & Vandevelde, S. (2014). Development of the Text-Learning Strategies Inventory: Assessing and Profiling Learning From Texts in Fifth and Sixth Grade. *Journal of Psychoeducational Assessment, 32*, 533-547. doi: 10.1177/0734282914525155

De Backer, L., Van Keer, H., Vandevelde, S., & Valcke, M. (2015). Eliciting co-regulation and socially shared metacognitive regulation through structuring and problematising scaffolds. Manuscript submitted for publication in *Metacognition and Learning*.

(p1)

Vandevelde, S., Vandenbussche, L., & Van Keer, H. (2012). Stimulating self-Regulated learning in primary education: encouraging versus hampering factors for teachers. In Z. Bekirogullari (Ed.), Procedia Social and Behavioral Sciences. (Vol. 69, pp. 1562-1571). doi: 10.1016/j.sbspro.2012.12.099

Conference contributions

Vandevelde, S., & Van Keer, H. (2012). *Stimulating self-regulated learning in primary education: Encouraging versus hampering factors for teachers.* Paper presented at the International Conference on Education and Educational Psychology (ICEEPSY), Istanbul, Turkey, 10 - 13 October 2012.

Vandevelde, S., & Van Keer, H. (2013). *Promoting self-regulated learning in primary education: a challenge for teachers.* Paper presented at the 16th Biennial Conference on Teachers and Teaching (ISATT), Ghent, Belgium, 1 - 5 July 2013.

Vandevelde, S., Goormachtigh, A., & Van Keer, H. (2015). *The transition from elementary to secondary school: How does self-regulated learning strategy use evolves*? Paper accepted to be presented at the annual meeting of the American Educational Research Association (AERA), Chicago, Illinois, 16 - 20 April 2014

Vandevelde, S., Roose, E., Dhuyvetter, S., & Van Keer, H. (2015). *Teachers' promotion of self-regulated learning: A comparison between regular and special education teachers.* Poster accepted to be presented at the annual meeting of the American Educational Research Association (AERA), Chicago, Illinois, 16 - 20 April 2014.

Vandevelde, S., & Van Keer, H. (2015). *Promoting self-regulated learning: A challenging endeavour for primary school teachers.* Paper accepted to be presented at the symposium 'Perspectives on students' and teachers' self-regulated learning in the classroom' at the European Association for Research on Learning and Instruction (EARLI) Conference, Limassol, Cyprus, 25 – 29 August 2015.

Thomas, V., Van Keer, H., Vandevelde, S., Peeters, J., De Backer, F., Kindekens, A., Lombaerts, K. (2015). *Self-regulated skills during homework in primary school: a learning diary study.* Poster accepted to be presented at the European Association for Research on Learning and Instruction (EARLI) Conference, Limassol, Cyprus, 25 – 29 August 2015.

Data storage fact sheets

% Data Storage Fact Sheet 1

% Name/identifier study: Chapter 2

% Author: Sabrina Vandevelde

% Date: March, 2, 2015

1. Contact details

===

1a. Main researcher

- name: Sabrina Vandevelde
- address: Henri Dunantlaan 2 - 9000 Ghent - Belgium
- e-mail: Sabrina.Vandevelde@UGent.be

1b. Responsible Staff Member (ZAP)

- name: Hilde Van Keer (promotor PhD project)
- address: Henri Dunantlaan 2 - 9000 Ghent - Belgium
- e-mail: Hilde.Vankeer@UGent.be

If a response is not received when using the above contact details, please send an email to data.pp@ugent.be or contact Data Management, Faculty of Psychology and Educational Sciences, Henri Dunantlaan 2, 9000 Ghent, Belgium.

2. Information about the datasets to which this sheet applies

==

* Reference of the publication in which the datasets are reported:

Vandevelde, S., Van Keer, H., & De Wever, B. (2011). Exploring the impact of student tutoring on at-risk fifth and sixth graders' self-regulated learning. Learning and Individual Differences, 21(4), 419-425. doi: 10.1016/j.lindif.2011.01.006

* Which datasets in that publication does this sheet apply to?:

Both datasets included in the study reported in Chapter 2 of the dissertation.

3. Information about the files that have been stored

==

3a. Raw data

----

* Have the raw data been stored by the main researcher? [X] YES / [ ] NO

If NO, please justify:

* On which platform are the raw data stored?

1. Student survey data (Learning motivation test + Jr. MAI):

- [ ] researcher PC
- [ ] research group file server
- [X] other (specify): paper version stored in the researcher's office

2. Structured interview schedule:

- [ ] researcher PC
- [ ] research group file server
- [X] other (specify): paper version stored in the researcher's office

* Who has direct access to the raw data (i.e., without intervention of another person)?

- [X] main researcher
- [ ] responsible ZAP
- [ ] all members of the research group
- [ ] all members of UGent
- [ ] other (specify): ...

3b. Other files

----

* Which other files have been stored?

- [X] file(s) describing the transition from raw data to reported results. Specify: A detailed coding scheme to analyse the structured interview was stored as excel-file; SPSS syntax files were stored regarding the different analysis as reported in chapter 2 of the dissertation
- [X] file(s) containing processed data. Specify: student survey data was processed (i.e. cleaned data in SPSS, aggregated for analysis); all structured interviews were coded and subsequently processed (i.e. cleaned data in SPSS, aggregated for analysis)
- [X] file(s) containing analyses. Specify: SPSS-generated output (i.e. output of priliminary analyses as well as output of the main analyses regarding the research questions) was stored as .spv files.
- [ ] files(s) containing information about informed consent
- [ ] a file specifying legal and ethical provisions
- [ ] file(s) that describe the content of the stored files and how this content should be interpreted. Specify: ...
- [ ] other files. Specify: ...

* On which platform are these other files stored?

  - [X] individual PC

  - [ ] research group file server

  - [ ] other: ...

* Who has direct access to these other files (i.e., without intervention of another person)?

  - [X] main researcher

  - [ ] responsible ZAP

  - [ ] all members of the research group

  - [ ] all members of UGent

  - [ ] other (specify): ...

4. Reproduction

===

* Have the results been reproduced independently?: [ ] YES / [X] NO

* If yes, by whom (add if multiple):

   - name:

   - address:

   - affiliation:

   - e-mail:

% Data Storage Fact Sheet 2

% Name/identifier study: Chapter 3

% Author: Sabrina Vandevelde

% Date: March, 2, 2015

1. Contact details

===

1a. Main researcher

- name: Sabrina Vandevelde
- address: Henri Dunantlaan 2 - 9000 Ghent - Belgium
- e-mail: Sabrina.Vandevelde@UGent.be

1b. Responsible Staff Member (ZAP)

- name: Hilde Van Keer (promotor PhD project)
- address: Henri Dunantlaan 2 - 9000 Ghent - Belgium
- e-mail: Hilde.Vankeer@UGent.be

If a response is not received when using the above contact details, please send an email to data.pp@ugent.be or contact Data Management, Faculty of Psychology and Educational Sciences, Henri Dunantlaan 2, 9000 Ghent, Belgium.

2. Information about the datasets to which this sheet applies

===

* Reference of the publication in which the datasets are reported:

Vandevelde, S., Van Keer, H., & Rosseel, Y. (2013). Measuring the complexity of upper primary school children's self-regulated learning: A multi-component approach. Contemporary Educational Psychology, 38, 407-425. doi: 10.1016/j.cedpsych.2013.09.002

* Which datasets in that publication does this sheet apply to?:

Both datasets (dataset of sample 1 and dataset of sample 2) included in the study reported in Chapter 3 of the dissertation.

3. Information about the files that have been stored

===

3a. Raw data

----

* Have the raw data been stored by the main researcher? [X] YES / [ ] NO

If NO, please justify:

* On which platform are the raw data stored?

1. Student survey data:

- [ ] researcher PC
- [ ] research group file server
- [X] other (specify): paper version stored in the researcher's office

* Who has direct access to the raw data (i.e., without intervention of another person)?

 - [X] main researcher

 - [ ] responsible ZAP

 - [ ] all members of the research group

 - [ ] all members of UGent

 - [ ] other (specify): ...

3b. Other files

----

* Which other files have been stored?

 - [X] file(s) describing the transition from raw data to reported results. Specify: SPSS syntax files and R syntax files were stored.

 - [X] file(s) containing processed data. Specify: student survey data was processed (i.e. cleaned data in SPSS, aggregated for analysis, transformed into .csv-file format for analysis in R - Lavaan)

 - [X] file(s) containing analyses. Specify: SPSS-generated output (i.e. output of priliminary analyses as well as output of the main analyses regarding the research questions) was stored as .spv files; R output (i.e. output of priliminary analyses as well as output of the main analyses regarding the research questions) was stored as .txt file.

 - [ ] files(s) containing information about informed consent

 - [ ] a file specifying legal and ethical provisions

 - [ ] file(s) that describe the content of the stored files and how this content should be interpreted. Specify: ...

 - [ ] other files. Specify: ...

* On which platform are these other files stored?

 - [X] individual PC

 - [ ] research group file server

 - [ ] other: ...

* Who has direct access to these other files (i.e., without intervention of another person)?

 - [X] main researcher

 - [ ] responsible ZAP

 - [ ] all members of the research group

 - [ ] all members of UGent

 - [ ] other (specify): ...

4. Reproduction

==

* Have the results been reproduced independently?: [ ] YES / [X] NO

* If yes, by whom (add if multiple):

  - name:

  - address:

  - affiliation:

  - e-mail:

% Data Storage Fact Sheet 3

% Name/identifier study: Chapter 4

% Author: Sabrina Vandevelde

% Date: March, 2, 2015

1. Contact details

===

1a. Main researcher

- name: Sabrina Vandevelde
- address: Henri Dunantlaan 2 - 9000 Ghent - Belgium
- e-mail: Sabrina.Vandevelde@UGent.be

1b. Responsible Staff Member (ZAP)

- name: Hilde Van Keer (promotor PhD project)
- address: Henri Dunantlaan 2 - 9000 Ghent - Belgium
- e-mail: Hilde.Vankeer@UGent.be

If a response is not received when using the above contact details, please send an email to data.pp@ugent.be or contact Data Management, Faculty of Psychology and Educational Sciences, Henri Dunantlaan 2, 9000 Ghent, Belgium.

2. Information about the datasets to which this sheet applies

===

* Reference of the publication in which the datasets are reported:

Vandevelde, S., Van Keer, H., Schellings, G. & van Hout-Wolters, B. (2015). Using think-aloud protocol analysis to gain in-depth insights into upper primary school children's self-regulated learning. Manuscript submitted for publication in Learning and Individual differences.

* Which datasets in that publication does this sheet apply to?:

Dataset included in the study reported in Chapter 4 of the dissertation

3. Information about the files that have been stored

===

3a. Raw data

----

* Have the raw data been stored by the main researcher? [X] YES / [ ] NO

If NO, please justify:

* On which platform are the raw data stored?

1. Video- and audio data of think-aloud sessions:

- [ ] researcher PC
- [ ] research group file server
- [X] other (specify): external hard disk stored in the researcher's office

* Who has direct access to the raw data (i.e., without intervention of another person)?

- [X] main researcher
- [ ] responsible ZAP
- [ ] all members of the research group
- [ ] all members of UGent
- [ ] other (specify): ...

3b. Other files

----

* Which other files have been stored?

- [X] file(s) describing the transition from raw data to reported results. Specify: a coding scheme to analyse think-aloud data was stored as a word file; SPSS syntax files were stored.
- [X] file(s) containing processed data. Specify: all think-aloud sessions were transcribed and stored as word files; all think-aloud data was processed (i.e. cleaned data in SPSS, aggregated for analysis, transformed into . xlsx file to generate graphs)
- [X] file(s) containing analyses. Specify: SPSS-generated output (i.e. output of priliminary analyses as well as output of the main analyses regarding the research questions) was stored as .spv files; individual and cross-case reports were stored as word files and .xlsx files.
- [ ] files(s) containing information about informed consent
- [ ] a file specifying legal and ethical provisions
- [ ] file(s) that describe the content of the stored files and how this content should be interpreted. Specify: ...
- [ ] other files. Specify: ...

* On which platform are these other files stored?

- [X] individual PC
- [ ] research group file server
- [ ] other: ...

* Who has direct access to these other files (i.e., without intervention of another person)?

  - [X] main researcher
  - [ ] responsible ZAP
  - [ ] all members of the research group
  - [ ] all members of UGent
  - [ ] other (specify): ...

4. Reproduction

===

* Have the results been reproduced independently?: [ ] YES / [X] NO

* If yes, by whom (add if multiple):

   - name:
   - address:
   - affiliation:
   - e-mail:

% Data Storage Fact Sheet 4

% Name/identifier study: Chapter 5

% Author: Sabrina Vandevelde

% Date: March, 2, 2015

1. Contact details

===

1a. Main researcher

- name: Sabrina Vandevelde
- address: Henri Dunantlaan 2 - 9000 Ghent - Belgium
- e-mail: Sabrina.Vandevelde@UGent.be

1b. Responsible Staff Member (ZAP)

- name: Hilde Van Keer (promotor PhD project)
- address: Henri Dunantlaan 2 - 9000 Ghent - Belgium
- e-mail: Hilde.Vankeer@UGent.be

If a response is not received when using the above contact details, please send an email to data.pp@ugent.be or contact Data Management, Faculty of Psychology and Educational Sciences, Henri Dunantlaan 2, 9000 Ghent, Belgium.

2. Information about the datasets to which this sheet applies

===

* Reference of the publication in which the datasets are reported:

Vandevelde, S., Van Keer, H., & Merchie, E. (2014). The challenge of promoting self-regulated learning among primary school children with a low socio-economic and immigrant background. Manuscript accepted for publication in Journal of Educational Research.

* Which datasets in that publication does this sheet apply to?:

Datasets (survey data + think-aloud data) included in the study reported in Chapter 5 of the dissertation.

3. Information about the files that have been stored

===

3a. Raw data

----

* Have the raw data been stored by the main researcher? [X] YES / [ ] NO

If NO, please justify:

* On which platform are the raw data stored?

1. Survey data of teachers:

- [ ] researcher PC
- [ ] research group file server
- [X] other (specify): paper version stored in the researcher's office

2. Survey data of students:

- [ ] researcher PC
- [ ] research group file server
- [X] other (specify): paper version stored in the researcher's office

3. Video- and audio data of think-aloud sessions:

- [ ] researcher PC
- [ ] research group file server
- [X] other (specify): external hard disk stored in the researcher's office

* Who has direct access to the raw data (i.e., without intervention of another person)?

- [X] main researcher
- [ ] responsible ZAP
- [ ] all members of the research group
- [ ] all members of UGent
- [ ] other (specify): ...

3b. Other files

----

* Which other files have been stored?

- [X] file(s) describing the transition from raw data to reported results. Specify: a coding scheme to analyse think-aloud data was stored as a word file; SPSS syntax files were stored.

- [X] file(s) containing processed data. Specify: student survey data was processed (i.e. cleaned data in SPSS, aggregated for analysis); all structured interviews were coded and subsequently processed (i.e. cleaned data in SPSS, aggregated for analysis); all think-aloud sessions were transcribed and stored as word files; all think-aloud data was processed (i.e. cleaned data in SPSS, aggregated for analysis).

- [X] file(s) containing analyses. Specify: SPSS-generated output (i.e. output of priliminary analyses as well as output of the main analyses regarding the research questions) was stored as .spv files.

- [ ] files(s) containing information about informed consent
- [ ] a file specifying legal and ethical provisions
- [ ] file(s) that describe the content of the stored files and how this content should be interpreted. Specify: ...
- [ ] other files. Specify: ...

* On which platform are these other files stored?
- [X] individual PC
- [ ] research group file server
- [ ] other: ...

* Who has direct access to these other files (i.e., without intervention of another person)?
- [X] main researcher
- [ ] responsible ZAP
- [ ] all members of the research group
- [ ] all members of UGent
- [ ] other (specify): ...

4. Reproduction
==

* Have the results been reproduced independently?: [ ] YES / [X] NO

* If yes, by whom (add if multiple):
  - name:
  - address:
  - affiliation:
  - e-mail:

% Data Storage Fact Sheet 5

% Name/identifier study: Chapter 6

% Author: Sabrina Vandevelde

% Date: March, 2, 2015

1. Contact details

===

1a. Main researcher

- name: Sabrina Vandevelde

- address: Henri Dunantlaan 2 - 9000 Ghent - Belgium

- e-mail: Sabrina.Vandevelde@UGent.be

1b. Responsible Staff Member (ZAP)

- name: Hilde Van Keer (promotor PhD project)

- address: Henri Dunantlaan 2 - 9000 Ghent - Belgium

- e-mail: Hilde.Vankeer@UGent.be

If a response is not received when using the above contact details, please send an email to data.pp@ugent.be or contact Data Management, Faculty of Psychology and Educational Sciences, Henri Dunantlaan 2, 9000 Ghent, Belgium.

2. Information about the datasets to which this sheet applies

===

* Reference of the publication in which the datasets are reported:

Vandevelde, S., Van Keer, H., De Backer, L., Van Steenbrugge, H., & Mertens, C. (2015). Unravelling tutoring processes during student tutoring focusing on self-regulated learning. Manuscript submitted for publication in Cognition and Instruction.

* Which datasets in that publication does this sheet apply to?:

Dataset included in the study reported in Chapter 6 of the dissertation

3. Information about the files that have been stored

===

3a. Raw data

----

* Have the raw data been stored by the main researcher? [X] YES / [ ] NO

If NO, please justify:

* On which platform are the raw data stored?

1. Video- and audio data of tutoring sessions:

- [ ] researcher PC
- [ ] research group file server
- [X] other (specify): external hard disk stored in the researcher's office

* Who has direct access to the raw data (i.e., without intervention of another person)?

- [X] main researcher
- [ ] responsible ZAP
- [ ] all members of the research group
- [ ] all members of UGent
- [ ] other (specify): ...

3b. Other files

----

* Which other files have been stored?

- [X] file(s) describing the transition from raw data to reported results. Specify: a coding scheme to analyse process data was stored as a word file; SPSS syntaxs and R syntaxs were stored.

- [X] file(s) containing processed data. Specify: coding of video-data were stored as . xlsx file; all process data was processed (i.e. cleaned data in SPSS, aggregated for analysis, transformed to .csv file for analysis in R).

- [X] file(s) containing analyses. Specify: SPSS-generated output (i.e. output of priliminary analyses as well as output of the main analyses regarding the research questions) was stored as .spv files; generated graphs were stored as .xlsx files.

- [ ] files(s) containing information about informed consent

- [ ] a file specifying legal and ethical provisions

- [ ] file(s) that describe the content of the stored files and how this content should be interpreted. Specify: ...

- [ ] other files. Specify: ...

* On which platform are these other files stored?

- [X] individual PC
- [ ] research group file server
- [ ] other: ...

* Who has direct access to these other files (i.e., without intervention of another person)?

  - [X] main researcher
  - [ ] responsible ZAP
  - [ ] all members of the research group
  - [ ] all members of UGent
  - [ ] other (specify): ...

4. Reproduction

===

* Have the results been reproduced independently?: [ ] YES / [X] NO

* If yes, by whom (add if multiple):

   - name:
   - address:
   - affiliation:
   - e-mail: